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New York State Museum

CHARLES H. PECK State Botanist

Bulletin 75

BOTANY 7

REPORT OF THE STATE BOTANIST 1903

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ALBANY

UNIVERSITY OF THE STATE OF NEW YORK

1904

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University of the State of New York

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New York State Museum

FREDERICK J. H. MERRILL Director

CHARLES H. PECK State Botanist

Bulletin 75

BOTANY 7

REPORT OF THE STATE BOTANIST 1903

To the Regents of the University of the State of New York

I have the honor of submitting to you the following report of work done in the botanical department of the State Museum during the past year.

Specimens of plants for the herbarium have been collected in the counties of Albany, Columbia, Essex, Hamilton, Oswego, Rensselaer, Saratoga, Schoharie, Warren and Washington. Specimens that were collected in the counties of Chautauqua, Chemung, Essex, Herkimer, Onondago, Ontario, Richmond, Saratoga, Schoharie, Seneca, Steuben, Suffolk, Wayne and Westchester have been received from correspondents.

Specimens collected and contributed represent 193 species. Of these, 46 are new to the herbarium and 13 are considered new or undescribed species. Of the 46 species, 35 are from the collections of the state botanist, 11 from those of correspondents. Of the 13 species, 12 belong to the collections of the botanist, one to those of his correspondents. A list of the names of the species added to the herbarium is marked **A**.

A list of the names of contributors and of the names of their respective contributions is marked **B**. The number of those who have contributed specimens is 41. Some of the specimens contributed belong to extralimital species. Some were sent merely for identification, but if for any reason their preservation seemed

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desirable and their condition was satisfactory, they have been preserved and credited to the sender as a contribution. The number of those who have sent specimens for identification is 90, the number of identifications made is 623.

Names of species added to our flora, with notes concerning their habitats, localities and time of collection of the specimens, with descriptions of new species are contained in a part of the report marked C.

Remarks and observations on species previously reported, new stations of rare plants, unusual habits and descriptions of new varieties may be found in a part of the report marked D.

Specimens of many species of fleshy, corky and coriaceous fungi are specially subject to the attacks of destructive insects. In order to attain greater security against these attacks a series of such specimens representing about 500 species has been placed in small pasteboard boxes with close fitting covers. These boxes are in different sizes that they may be suitable for the reception of specimens of species of different sizes. The dimensions of the boxes vary in such a way that they present a certain degree of uniformity when arranged in proper order on the shelves of wall cases. They are 3x4, 4x6 or 6x8 inches in width and length and $1\frac{1}{4}$ or $2\frac{1}{2}$ inches deep. The alphabetic arrangement of the genera represented by their contents has been adopted to facilitate reference to them.

The investigation of our mushroom flora has been continued, but the crop of wild mushrooms has been unusually deficient and the additions to the herbarium correspondingly small. Still, a few species have been tested for their edible qualities and found to be worthy of addition to the list of New York edible species. Colored figures of these have been prepared and plain descriptions of them may be found in a part of the report marked E.

In my last report the general deficiency of the mushroom crop and the almost total absence of the common mushroom, *Agaricus campester*, were recorded and the peculiar character of the season was assigned as the probable cause. The season of 1903 has been similar to that of 1902 in its abundance

of rain and in its prevailing low temperature. It has also been similar, at least in the eastern part of the State, in its adverse influence on mushroom growth. In some respects its adverse character seems to have been intensified. Possibly the excessive drouth in the early part of the season may to some extent be responsible for this by preventing the development of the mycelium of some species. In 1895 and 1896 the abundance of the crop of the common mushroom and of the smooth mushroom was remarkable. They had then apparently reached their greatest abundance. In the few following years they appeared in moderate but diminishing quantity. In 1901 but few were seen in the vicinity of Albany. In 1902 they were still less in number and in 1903 I did not see a single specimen of the common mushroom in the whole region about Albany. This species at least seems to have reached its lowest point of productiveness. The probability is that there will now be a gradual return to greater crops of this mushroom. It is very evident that much moisture, specially if attended by prevailing low temperature, is not favorable to large crops of mushrooms. Probably the most favorable seasons will be found to be those of moderate rainfall and medium or rather high temperature, the rains being gentle and frequent.

Specimens of about 75 species and varieties of edible mushrooms have been placed in trays and arranged in table cases for permanent exhibition. Specimens of species of fungi injurious to wood have also been placed in table cases, and also species of parasitic fungi destructive to cultivated and useful plants. These and samples of wood and bark affected by mycelium of various wood-destroying fungi constitute an economic collection of fungi which should be instructive and of popular interest.

The study of the Crataegus flora of the eastern part of the State has been continued and considerable time devoted to it. Specimens have been collected in the counties of Albany, Saratoga, Warren, Essex, Washington, Rensselaer and Columbia. A few have also been collected in the counties of Hamilton and Schoharie, but only a single visit was made to each of these localities,

and therefore the specimens from them are too incomplete to be satisfactory. These places must be again visited earlier in the season in order to get flowering specimens. Those who have made a special study of these trees and shrubs and have recently published many new species have given specific value to such characters as require a very complete set of specimens to make the identification certain and satisfactory. There are also some characters that are not well shown by the dried specimens and in order to make these available notes must be taken of them at the time the specimens are collected. The number of species recently described is so great that it seems very probable that mere varieties and perhaps mere forms have been in some cases described as species. But error in this direction may have a tendency to stimulate closer observation on the part of others in their efforts to recognize the fine distinctions made and may in the end be productive of better results than error in the other direction would be. According to the present understanding of these plants the number of species of *Crataegus* added to our flora is 19. They are specially noticed in a part of the report marked **F**.

A supplementary list of plants of the Susquehanna valley is marked **G**. It is composed of the names and annotations of species detected since the previous list was written and of species accidentally omitted from that list. It includes about 30 species.

Respectfully submitted

CHARLES H. PECK

Albany, Dec. 2, 1903

A

PLANTS ADDED TO THE HERBARIUM

New to the herbarium

Asarum reflexum <i>Bick.</i>	Hebeloma socialis <i>Pk.</i>
Aster curvescens <i>Burgess</i>	Hypomyces boletinus <i>Pk.</i>
Crataegus ascendens <i>S.</i>	Hydnum balsameum <i>Pk.</i>
C. brainerdi <i>S.</i>	H. macrescens <i>Banker</i>
C. conjuncta <i>S.</i>	Inocybe castanea <i>Pk.</i>
C. contigua <i>S.</i>	I. excoriata <i>Pk.</i>
C. delucida <i>S.</i>	I. fallax <i>Pk.</i>
C. dilatata <i>S.</i>	I. serotina <i>Pk.</i>
C. dissona <i>S.</i>	I. squamosodisca <i>Pk.</i>
C. egglestoni <i>S.</i>	Isaria brachiata (<i>Batsch</i>) <i>Schum.</i>
C. exclusa <i>S.</i>	Iva xanthiifolia (<i>Fres.</i>) <i>Nutt.</i>
C. flabellata (<i>Spach</i>) <i>Rydb.</i>	Lactarius subvelutinus <i>Pk.</i>
C. gravesii <i>S.</i>	Nardia obovata (<i>Nees</i>)
C. irrasa <i>S.</i>	Oxalis brittonae <i>Small</i>
C. intricata <i>Lange</i>	Perilla frutescens (<i>L.</i>) <i>Britton</i>
C. lobulata <i>S.</i>	Phacelia dubia (<i>L.</i>) <i>Small</i>
C. praeoqua <i>S.</i>	Phaeopezia retiderma (<i>Cke.</i>) <i>Sacc.</i>
C. matura <i>S.</i>	Podosphaera leucotricha (<i>E. & E.</i>)
C. peckii <i>S.</i>	<i>Salm.</i>
C. succulenta <i>Lk.</i>	Sarcoscypha rhenana <i>Fckl.</i>
Daphne mezereum <i>L.</i>	Stereum burtianum <i>Pk.</i>
Entoloma griseum <i>Pk.</i>	Tricholoma subluteum <i>Pk.</i>
Geoglossum farlowi <i>Cke.</i>	Ulmaria rubra <i>Hill</i>
Haplosporella macluræ <i>E. & B.</i>	

Not new to the herbarium

Agaricus arvensis <i>Schaeff.</i>	Berberis vulgaris <i>L.</i>
Agrostemma githago <i>L.</i>	Bidens cernua <i>L.</i>
Agastache scrophulariaefolia (<i>Willd.</i>)	Boletus americanus <i>Pk.</i>
Agrostis perennans (<i>Walt.</i>) <i>Tuckerm.</i>	B. chry. albocarneus <i>Pk.</i>
Allium canadense <i>L.</i>	B. elbensis <i>Pk.</i>
A. vineale <i>L.</i>	B. luridus <i>Schaeff.</i>
Alsine graminea (<i>L.</i>) <i>Britton</i>	B. piperatus <i>Bull.</i>
Althaea rosea <i>Cav.</i>	B. rubinellus <i>Pk.</i>
Amelanchier botryapium (<i>L. f.</i>) <i>D C.</i>	Bromus tectorum <i>L.</i>
A. rotundifolia (<i>Mx.</i>) <i>Roem.</i>	Cantharellus cibarius <i>Fr.</i>
Antennaria parlinii <i>Fern.</i>	C. infundibuliformis (<i>Scop.</i>) <i>Fr.</i>
A. plantaginea <i>R. Br.</i>	C. tubaeformis <i>Fr.</i>
Arcyria punicea <i>Pers.</i>	Cardamine pennsylvanica <i>Muhl.</i>
Aster rosc. variifolius <i>Pk.</i>	Collybia acervata <i>Fr.</i>
A. undulatus <i>L.</i>	C. familia <i>Pk.</i>
	C. velutipes <i>Curt.</i>

- Claudopus nidulans (Pers.) Pk.
 Clavaria inaequalis Mull.
 C. krombholzii Fr.
 Conium maculatum L.
 Coprinus micaceus Fr.
 Cornus candidissima Marsh.
 C. stolonifera Mx.
 Cortinarius amarus Pk.
 C. canescens Pk.
 C. cinnabarinus Fr.
 C. rigidus Fr.
 C. uliginosus Berk.
 Craterellus clavatus (Pers.) Fr.
 Crataegus champlainensis S.
 C. coccinea L.
 C. crus-galli L.
 C. holmesiana Ashe
 C. macracantha Lodd.
 C. modesta S.
 C. oxyacantha L.
 C. pringlei S.
 C. pruinosa Wend.
 C. punctata Jacq.
 Dalibarda repens L.
 Daucus carota L.
 Echium vulgare L.
 Entoloma grayanum Pk.
 Euonymus obovatus Nutt.
 Fomes fomentarius (L.) Fr.
 F. igniarius (L.) Fr.
 F. pinicola Fr.
 Galera lateritia Fr.
 Galium mollugo L.
 G. tinctorium L.
 Gentiana andrewsii Griseb.
 Gratiola virginiana L.
 Hellopsis helianthoides (L.) B. S. P.
 Helvella ambigua Karst.
 Hirneola auricula-judae (L.) Berk.
 Hydnum coralloides Scop.
 H. grav. subzonatum Pk.
 Hygrophorus capreolaris Kalchb.
 H. pudorinus Fr.
 Hypericum arcyron L.
 Hypholoma capnoides Fr.
 H. subaquillum Bann.
 Hypocrea fungicola Karst.
 Lactarius affinis Pk.
 L. deliciosus Fr.
 L. glycosmus Fr.
 Lactarius subd. oculatus Pk.
 L. vellereus Fr.
 Lenzites sepiaria Fr.
 Lepiota amianthina Scop.
 Lychnis alba Mill.
 Lycoperdon perlatum Pers.
 Lycopodium clavatum L.
 L. obscurum L.
 Marasmius scorodonius Fr.
 Matricaria matricarioides (Less.)
 Porter
 Meibomia bracteosa (Mx.) Kuntze
 Melilotus officinalis (L.) Lam.
 Moneses uniflora (L.) Gray
 Mycena galericulata (Scop.) Fr.
 Myosotis laxa Lehm.
 Myrica gale L.
 Osmunda regalis L.
 Otidea onotica (Pers.) Fckl.
 Pinus echinata Mill.
 P. strobus L.
 Pleurotus porrigens Pers.
 Polyporus cuticularis (Bull.) Fr.
 P. picipes Fr.
 Polystictus abietinus Fr.
 P. hirsutus Fr.
 P. perennis (L.) Fr.
 Protomyces erythronii Pk.
 Puccinia suaveolens (Pers.) Rostr.
 Ribes floridum L'Her.
 R. rubrum L.
 Rubus canadensis L.
 R. nigrobaccus Bail.
 R. occid. pallidus Bail.
 Russula furcata (Pers.) Fr.
 R. dens. paxilloides Pk.
 R. flaviceps Pk.
 R. fragilis (Pers.) Fr.
 R. purpurina Q. & S.
 Salix discolor Muhl.
 S. fragilis L.
 Sanicula gregaria Bick.
 Scirpus atrocinctus Fern.
 S. atrovirens Muhl.
 S. pedicellatus Fern.
 Septoria rhoina B. & C.
 Sisymbrium altissimum L.
 Solidago canadensis L.
 Spiraea salicifolia L.
 Stropharia depilata (Pers.) Fr.

Symphytum officinale L.
Taraxacum taraxacum (L.) Karst.
Thelephora palmata (Scop.) Fr.
Thymus serpyllum L.
Tragopogon pratensis L.
Tricholoma sejunctum Sow.
T. *subacutum* Pk.
T. *vaccinum* (Pers.) Fr.
Ustilago zeae (Beckm.) Ung.

Uvularia sessilifolia L.
Valerianella radiata (L.) Dufour
Verbenia angustifolia Mx.
Viola blanda Willd.
V. *cucullata* Ait.
V. *labradorica* Schrank
V. *rotundifolia* Mx.
V. *selkirkii* Pursh

B

CONTRIBUTORS AND THEIR CONTRIBUTIONS

Mrs E. G. Britton, New York

Anomodon attenuatus Hueben.
A. *apiculatus* B. & S.
Bryum nutans Schreb.
Buxbaumia aphylla L.
Cephalozia curvifolia Dumort.
Collema plicatile Ach.
Cylindrothecium seductrix Sull.
Dicranum flagellare Hedw.
D. *viride* Schp.
Grimmia apocarpa Hedw.
Hypnum brevirostre Ehrh.
H. *chrysophyllum* Brid.
H. *imponens* Hedw.
H. *lindbergii* Limpt.
H. *novae-angliae* S. & L.
H. *proliferum* L.
H. *schreberi* Willd.

Hypnum triquetrum L.
Homalia gracilis James
Leptotrichum pallidum Hampe
Leucodon brachypus Brid.
Mnium aff. ciliare C. & M.
M. *cuspidatum* Hedw.
M. *medium* B. & S.
Philonotis fontana Brid.
Platygyrium repens B. & S.
Polytrichum juniperinum Willd.
Porella platyphylla Lindb.
Pylaisaea polyantha B. & S.
P. *velutina* B. & S.
Sphagnum cymbifolium Ehrh.
Trichostomum brev. holtii Dixon
Ulota crispa Brid.
Weisia viridula Brid.

Mrs H. C. Davis, Falmouth Me.

Thalesia uniflora (L.) Britton | *Lysimachia vulgaris* L.

Mrs M. S. De Coster, Little Falls

Daphne mezereum L.

Mrs P. H. Dudley, New York

Carex stricta Lam. (Culms and leaves)

Mrs L. L. Goodrich, Syracuse

Phacelia dubia (L.) Small

Miss M. Hope, Seattle Wash.

Pseudotsuga mucronata Carr. (Piece of bark)

Mrs M. A. Knickerbocker, San Francisco Cal.

Arbutus menziesii Pursh

Quercus dumosa Nutt.

Tumion californicum Greene

Umbellularia californica Nutt.

Rhamnus californica Eschs.

Miss J. A. Moses, Jamestown

Viola rotundifolia Mx.

Miss E. S. Thomas, Schoharie
Craterellus clavatus (*Pers.*) *Fr.*

J. C. Arthur, Lafayette Ind.

Phragmidium speciosum <i>Fr.</i>	Uromyces acuminatus <i>Arth.</i>
Puccinia amphigena <i>Diet.</i>	Puccinia eleocharidis <i>Arth.</i>
Ravenelia portoricensis <i>Arth.</i>	

H. J. Banker, California Pa.

Craterellus dubius *Pk.*

W. C. Barbour, Sayre Pa.

Corticium salicinum <i>Fr.</i>	Irpex paradoxus (<i>Schrad.</i>) <i>Fr.</i>
Dasyscypha virginea (<i>Batsch</i>) <i>Fckl.</i>	Isaria brachiata (<i>Batsch</i>) <i>Schum.</i>
Fuligo violacea <i>Pers.</i>	Xylaria grandis <i>Pk.</i>

F. J. Braendle, Washington D.C.

Amanitopsis vaginata (<i>Bull.</i>) <i>Roze</i>	Flammula spumosa <i>Fr.</i>
Clitocybe virens (<i>Scop.</i>) <i>Fr.</i>	Lachnea hemisphaerica (<i>Wigg.</i>) <i>Gill.</i>
Collybia strictipes <i>Pk.</i>	Pholiota lutea <i>Pk.</i>
C. tort. setipes <i>Pk.</i>	Thelephora vialis <i>Schw.</i>

E. Bartholomew, Rockport Kan.

Tylostoma mammosum (<i>Mich.</i>) <i>Fr.</i>	Pluteus longistriatus <i>Pk.</i>
T. pocolatum <i>White</i>	

S. H. Burnham, Vaughns

Asarum reflexum <i>Bick.</i>	Paspalum muhlenbergii <i>Nash</i>
Aster curvescens <i>Burgess</i>	Perilla frutescens (<i>L.</i>) <i>Britton</i>
Oxalis brittonae <i>Small</i>	Xanthium commune <i>Britton</i>

G. D. Cornell, Cooper's Plains

Hydrangea arborescens <i>L.</i>	Lilium superbum <i>L.</i>
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J. Dearness, London Ont.

Diaporthe microstroma <i>E. & E.</i>	Hemitrichia vesparium (<i>Batsch</i>)
D. velata <i>Pers.</i>	Lycogala exiguum <i>Morg.</i>
Dichomera prunicola <i>E. & D.</i>	Trichia incarnata <i>Pers.</i>

W. G. Farlow, Cambridge Mass.

Nardia obovata *Nees*

F. E. Fenno, Nichols

Carex flava <i>L.</i>	Verbena angustifolia <i>Mx.</i>
Salix myrtilloides <i>L.</i>	Woodwardia virginica (<i>L.</i>) <i>Sm.</i>

A. O. Garratt, Salt Lake City Utah

Puccinia calochorti <i>Pk.</i>	Puccinia plumbaria <i>Pk.</i>
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C. Gramesly, Charleston Ill.

Agaricus abruptus *Pk.*

N. M. Glatfelter, St Louis Mo.

Flammula eccentrica <i>Pk.</i>	Pholiota autumnalis <i>Pk.</i>
Galera capillaripes <i>Pk.</i>	Russula luteobasis <i>Pk.</i>
Hypholoma ornellum <i>Pk.</i>	R. pusilla <i>Pk.</i>
Lactarius subvelutinus <i>Pk.</i>	Tricholoma viscosum <i>Pk.</i>
Pholiota deterribilis <i>Pk.</i>	

L. W. Hahn, Silver Creek

Euonymus obovatus Nutt.

C. C. Hanmer, East Hartford Ct.

Geoglossum farlowi Cke.

W. Herriot, Galt Ont.

Bromus cil. laeviglumis Scrib. | *Panicum lanuginosum Ell.*

R. B. Hough, Lowville

Pinus echinata Mill.

F. G. Howland, Saratoga

Collybia velutipes Curt.

R. B. Mackintosh, Peabody Mass.

Clitocybe cerussata Fr.

Deconica bryophila Pk.

Pleurotus petaloides (Bull.) Fr.

Tricholoma grammopodium (Bull.)

Fr.

C. McIlvaine, Cambridge Md.

Hypomyces viridis (A. & S.) Karst.

Panaeolus epimyces Pk.

Phytophthora phaseoli Thax.

W. S. Moffatt, Chicago Ill.

Clitocybe piceina Pk.

Pholiota comosa Fr.

G. E. Morris, Waltham Mass.

Boletinus grisellus Pk.

Boletus parasiticus Bull.

Lentinus tigrinus Fr.

Otidea onotica (Pers.) Fekl.

R. S. Phifer, Danville Va.

Boletus morgani Pk.

B. *caespitosus Pk.*

Polyporus curtisii Berk.

E. B. Sterling, Trenton N. J.

Geaster minimus Schw.

G. *pectinatus Pers.*

G. *giovanellae Bres.*

Catastoma subterraneum (Pk.) Morg.

Agaricus cothurnatus Pk.

A. *rutilescens Pk.*

A. *solidipes Pk.*

A. *sphaerosporus Pk.*

R. H. Stevens, Detroit Mich.

Helvella stevensii Pk.

F. C. Stewart, Geneva

Haplosporella macluræ E. & B.

D. R. Sumstine, Kittanning Pa.

Dictydiaethalium plumbeum

(*Schum.*)

Lentinus ursinus Fr.

Merulius tremellosus Schrad.

Podosphaera oxycanthæ DC.

Puccinia cryptotaeniae Pk.

Stropharia squam. aurantiaca Cke.

Urnula craterium (Schw.) Fr.

W. E. Warner, Washington D. C.

Amanita radicata Pk.

A. *musc. formosa (G. & R.)*

Pluteus cervinus (Schaeff.) Fr.

Polyporus cuticularis Fr.

B. C. Williams, Newark

Inocybe serotina Pk.

J. R. Cushier, New York City
Panaeolus solidipes *Pk.*

A. Knechtel, Albany
Picea canadensis (*Mill.*) *B. S. P.* (Trunk section)

L. H. Watson, Chicago Ill.
Clitocybe piceina *Pk.*

C

SPECIES NOT BEFORE REPORTED

Asarum reflexum Bick.

Ravines. Williams Bridge, Westchester co. May. S. H. Burnham.

Aster curvescens Burgess.

Woodlawn cemetery, Westchester co. July. S. H. Burnham.

Crataegus ascendens Sarg.

Clayey soil in pastures and borders of woods. North Greenbush and Rensselaer. May, July and September.

Crataegus brainerdi Sarg.

Rocky places in pastures. Sandlake. May and September.

Crataegus conjuncta Sarg.

Clayey and sandy soil. North Greenbush and in various places north and northeast of Albany. May, September and October.

Crataegus contigua Sarg.

Shaly soil. Lansingburg. May and September.

Crataegus delucida Sarg.

Clayey hillsides north of Albany. May and September.

Crataegus dilatata Sarg.

Clayey soil, roadsides and pastures. Thompsons Lake, Albany co. and Gansevoort, Saratoga co. June, July and September.

Crataegus dissona Sarg.

Clayey soil. Near Albany, Rensselaer, Lansingburg, Copake and Thompsons Lake. May, July and September.

Crataegus egglestoni Sarg.

Rocky places. Crown Point. May, July and September.

Crataegus exclusiva Sarg.

Clayey soil. Crown Point. May, July and September.

Crataegus flabellata (Spach) Rydb.

Rocky places near the lake shore. Crown Point. May and September. This is a beautiful species well marked by its deeply and sharply lobed shining leaves, its 20 stamens with pink anthers and its globose fruit.

Crataegus gravesii Sarg.

Clayey soil. Albany, North Greenbush and Westport. May, June, September and October.

Crataegus irrasa Sarg.

Clayey soil. North Greenbush. May, June and September.

Crataegus intricata Lange

Hillsides near Albany and north of Lansingburg. May, June and September.

Crataegus lobulata Sarg.

Clayey soil. Crown Point. May and September.

Crataegus macracantha Lodd.

Clayey and sandy soil. North Greenbush, Thompsons Lake, Fort Ann and North Elba. May, June and September. This was formerly reported as a variety of *Crataegus coccinea*, but is now considered a distinct species. The name indicates that it has long spines, but they are not always conspicuously long. Its stamens vary in number from 7 to 10 and its anthers are whitish or pale yellow.

Crataegus matura Sarg.

Rocky or bushy pastures. Gansevoort, Saratoga co. and Lake Pleasant, Hamilton co. June, August and September.

Crataegus peckii Sarg.

Shaly soil. North of Lansingburg. May and October.

Crataegus praecoqua Sarg.

Clayey soil. Crown Point. May and September. First discovered here by W. W. Eggleston.

Crataegus succulenta Link

Clayey soil. Albany, Albion, Rensselaer co. and Central Bridge, Schoharie co. May, July and September.

In view of the growing interest in the study of our species of *Crataegus* it has been thought best to give descriptions of such

of our species as are not described in any of our manuals. These descriptions and remarks on the genus will be found in another part of the report.

***Daphne mezereum* L.**

Gravesville, Herkimer co. Mrs M. S. DeCoster. The spurge laurel or mezereon is an introduced shrub. It is sometimes cultivated but escapes from cultivation and grows wild.

***Entoloma griseum* n. sp.**

Pileus fleshy, firm, broadly campanulate or convex, obtuse or slightly umbonate, glabrous, often irregular, hygrophanous, grayish brown when moist, paler when dry, flesh whitish, odor and taste farinaceous; lamellae adnexed, emarginate, with a decurrent tooth, about 2 lines broad, pale pink; stem equal or slightly tapering upward, silky fibrillose, pruinose or mealy at the top, stuffed or hollow, grayish white; spores angular, nearly as broad as long, .0003 of an inch long.

Pileus 1-3 inches broad; stem 1-2 inches long, 3-5 lines thick. Under spruce and balsam fir trees. Lake Pleasant. August.

It is closely related to *E. grayanum* from which it may be separated by its darker color, more narrow gills and different place of growth.

***Euonymus obovatus* Nutt.**

Woods. Silver creek, Chautauqua co. L. W. Hahn.

This decumbent or trailing shrub was reported by Dr Torrey to belong to our flora, but he considered it a mere variety of *Euonymus americanus*. It is now regarded as a distinct species differing from the strawberry bush in its smaller flowers, obtuse and more finely crenulate leaves, earlier time of flowering and decumbent or trailing mode of growth.

***Geoglossum farlowi* Cke.**

Fishers island, Suffolk co. September. C. C. Hanmer. This fungus is much like *G. hirsutum* in external appearance, but its spores have but three septa.

***Haplosporella macluræ* E. & B.**

Dead stems of wistaria. Geneva. April. F. C. Stewart.

Hebeloma socialis n. sp.

Pileus fleshy but thin, convex, becoming plane or nearly so, glabrous, slightly viscid when moist, dingy yellowish white, flesh concolorous, taste nauseous; lamellae thin, close, slightly rounded behind, adnexed, at first whitish, then yellowish, finally brownish ferruginous; stem short, fibrous, floccose fibrillose, hollow with a small cavity, white; spores brownish ferruginous, elliptic, .00025-.0003 of an inch long, .00016-.0002 broad.

Pileus 8-15 lines broad; stem 12-18 lines long, 1.5-3 lines thick. Closely gregarious or subcespitose. Among short grass in pastures and golf ground. Menands. October. Distinguished from our other white or whitish species by its peculiar habitat and mode of growth and by its small spores.

Hypomyces boletinus n. sp.

Perithecia minute, conic or subglobose, closely nestling in a pallid or whitish subiculum, pale red or orange; asci slender, linear, .004-.005 of an inch long, scarcely .0003 broad; spores subfusiform, continuous, acuminate or apiculate at one end, .0008-.001 of an inch long, .00025 broad.

On some unrecognized decaying boletus, associated with *Sepedonium chrysospermum*. It differs from *H. polyporinus*, to which it is most closely related, in its more highly colored perithecia and longer spores, and from *H. boleticola* in the color of the subiculum.

Hydnum balsameum n. sp.

Resupinate with a very thin whitish or pallid subiculum; aculei mere conic brown points closely scattered but not crowded, giving to the surface a brown color.

Decorticated wood of balsam fir. North Elba. September. It sometimes grows on the bark also.

Hydnum macrescens Banker in lit.

Resupinate, effused, the thin subiculum less than 1 mm thick, ochraceous, subfarinaceous, specially in the thinner portions and on the woody substratum, rimose, the margin indeterminate; mycelium white, arachnoid, spreading in places beyond the subic-

ulum; teeth scattered, minute, .1-.25 mm long, .05-.1 mm broad, obtuse, often forked, colored like the subiculum but paler or white at the subciliate tips. Growing chiefly on the hymenial surface of *Stereum frustulosum* but often spreading over the substratum of decayed wood. Mt McGregor, Saratoga co. July.

The growth is most vigorous on the surface of the *Stereum*, where the subiculum becomes thickest and the teeth most numerous. On the woody substratum the growth is poor, the subiculum is thin and often the mycelium spreads naked over the surface of the wood. This has suggested the specific name. The thinning out of the subiculum indicates that the fungus finds its proper nourishment in the tissues of the *Stereum* and it is doubtful if it will be found dissociated from that plant. It appears to be related to *H. sulphurellum* Pk. but differs from it in color, in the indeterminate margin and in the ciliate teeth.

Inocybe castanea n. sp.

PLATE O, FIG. 1-8

Pileus conic or convex, umbonate, rimose fibrillose, the margin incurved, dark chestnut brown; lamellae thin, narrow, close, adnate, whitish or pallid when young, ferruginous brown when mature; stem equal, hollow, glabrous, slightly pruinose or mealy at the top; paler than the pileus; often whitened at the base by mycelioid tomentum; spores angular, nearly or quite as broad as long, .00025-.0003 of an inch long and broad; cystidia subfusiform, .002-.0024 of an inch long.

Pileus 5-8 lines broad; stem 10-18 lines long, about 1 line thick. Mossy ground under spruce and balsam fir trees. Lake Pleasant. August.

This species is very closely related to *I. umboninata* from which it may be separated by its smaller size, the chestnut tint of the cap, its hollow stem and smaller merely angular spores. Cystidia are more abundant. The species belongs to section *Rimosi*.

Inocybe excoriata n. sp.

PLATE O, FIG. 14-19

Pileus fleshy, broadly conic, soon broadly convex, umbonate, fibrillose or fibrillose squamulose, somewhat silky or tomentose

on the margin, grayish brown or pale vandyke brown, the cuticular surface often cracking and separating in places but remaining on the disk and sometimes on the margin, flesh white; lamellae narrow, close, emarginate, adnexed, decurrent with a tooth, crenulate on the edge, white becoming brownish gray; stem equal, solid, silky fibrillose, white or whitish without and within; spores yellowish brown (raw umber), elliptic, even, .0003-.0004 of an inch long, .0002-.00024 broad; cystidia flask shape, .002-.0024 of an inch long.

Pileus 1-2 inches broad; stem 1-2 inches long, 2-3 lines thick. Among fallen leaves in woods. Lake Pleasant. August.

The surface of the pileus cracks longitudinally and therefore the species belongs to the section Rimosi. The peeling and disappearance of parts of the cuticle suggest the specific name. A slight whitish webby veil is present in the young plant.

Inocybe fallax n. sp.

PLATE O, FIG. 20-24

Pileus thin, campanulate or convex, umbonate, obscurely fibrillose, sometimes minutely and obscurely squamulose, whitish or buff white, somewhat shining, the margin decurved or incurved, often splitting; lamellae thin, close, rounded behind, slightly adnexed, pallid when young, becoming rusty brownish when old; stem long, equal, hollow, flexuous, minutely pruinose, mealy, whitish; spores angular, slightly nodulose, .0003-.0004 of an inch long, .00024-.0003 broad; cystidia .0016-.002 of an inch long, .0006-.0007 broad, oblong elliptic.

Pileus 1-2 inches broad; stem 2-3 inches long, 2-4 lines thick. Among fallen leaves in woods. Lake Pleasant. August.

This species might easily be taken for a large form of *I. geophylla*, but an examination of its spores shows it to be distinct. Its cystidia are short and broad.

Inocybe serotina n. sp.

Pileus fleshy, firm, varying from campanulate to nearly plane, fibrillose toward the margin, white, sometimes tinged with yellow or brownish yellow, flesh white; lamellae close, rounded behind, nearly free, subventricose in fully expanded specimens, whitish

becoming brownish cinnamon; stem nearly equal, bulbous or narrowed at the base, long or short, solid, fibrous, white; spores oblong, even, .0005-.0006 of an inch long, .00024-.0003 broad.

Pileus 1-2.5 inches broad; stem 1-2 inches long, 3-6 lines thick. Sandy shores of Sodus bay and Lake Ontario. October. E. B. Burbank. Communicated by B. C. Williams.

Related to *I. sambucina* from which it differs in the fibrillose margin of the cap, in the darker color of the mature lamellae, in the larger spores and in its habitat. From *Hebeloma colvini*, which also grows in sandy soil, it differs in its whitish color, longer spores and solid stem. Its mycelium binds together a mass of sand which forms a somewhat bulbous base to the stem. Mr Burbank says that it occurred in great abundance in October and that it is edible.

Inocybe squamosodisca n. sp.

PLATE O, FIG. 10-13

Pileus fleshy, firm, convex, dry, fibrillose on the margin, rimose squamose in the center, ochraceous buff, flesh whitish or yellowish white; lamellae rather broad, moderately close, adnate, pale ochraceous, becoming darker with age; stem short, firm, equal, solid, fibrillose, colored like the pileus; spores elliptic, even, .0003-.0004 of an inch long, .0002-.00024 broad.

Pileus 1-2 inches broad; stem about 1 inch long, 2-3 lines thick. Gregarious. Under pine trees. Shore of Sacandaga lake. August.

The scales of the pileus are flat and spotlike and are formed by the cracking of the cuticle.

Isaria brachiata (Batsch) Schum.

On decaying *Tremellodon gelatinosum*. Van Etten. October. W. C. Barbour.

Iva xanthiifolia (Fres.) Nutt.

Waste places in the northern part of Albany. August. Introduced from the west but growing freely here.

Lactarius subvelutinus n. sp.

Pileus fleshy, firm, convex or nearly plane, subumbilicate, dry, minutely velvety or pruinose velvety, sometimes rugose, golden tawny, flesh white, milk white, taste mild; lamellae narrow,

close, adnate or slightly decurrent, yellowish or cream color, becoming darker with age; stem short, equal, solid, colored like or a little paler than the pileus; spores white, globose, nearly smooth, .0003 of an inch broad.

Pileus 1-2 inches broad; stem .5-1 inch long, 2-4 lines thick. Woods and open places. Meadowdale and Cemetery, Albany co. August.

Nardia obovata Nees

Rocks. Rainbow falls near Lower Ausable lake, Essex co. September. W. G. Farlow.

Oxalis brittonae Small

Van Cortland park, Westchester co. June. S. H. Burnham.

Perilla frutescens (L.) Britton

Sleepy Hollow near Tarrytown. October. S. H. Burnham.

This is an introduced species.

Phacelia dubia (L.) Small

Shady places on limestone rocks near Jamesville, Onondaga co. October. Mrs L. L. Goodrich.

In our botanies, Pennsylvania is the northeastern limit assigned to the range of this plant. Its discovery near Jamesville by Mrs Goodrich extends its range northward and adds a beautiful little wild flower to our flora. Its usual flowering time is in spring, but these specimens were found in flower the last week in October. The plants grew in patches several feet in diameter. The species is described in Gray's *Manual* under the name *Phacelia parviflora* Pursh.

Phaeopezia retiderma (Cke.) Sacc.

Ground in shaded places. Sandlake, Rensselaer co.

Podosphaera leucotricha (E. & E.) Salmon

Parasitic on living twigs of appletrees. Clyde, Wayne co. W. L. Devereaux.

This species of mildew is peculiar in its perithecia having two sets of appendages, one apical, the other basal. It is specially injurious to the young branches of trees in the nursery, but it rarely attacks the twigs of old trees, though suckers from the base or roots are said to be more liable to attack.

Puccinia simillima Arthur

Leaves and sheaths of *Phragmites phragmites*. Near Savannah, Wayne co. September.

Paspalum muhlenbergii Nash

Bedford Park, Westchester co. September. S. H. Burnham.

Paspalum prostratum Nash

Sandy soil. Manor, Suffolk co. August.

Russula densifolia Secr.

Among decaying leaves in woods. Lake Pleasant. August. This species is closely related to *R. adusta* from which it may be separated by the slight reddening of the flesh where wounded. Our specimens are a peculiar form in which many of the lamellae are forked at the base. They also separate at the inner extremity from the stem and pileus and curl outward revealing the hymenophore beneath. All the specimens found exhibited this character. It indicates a feeble attachment of the hymenium to the hymenophore and is suggestive of a relationship to the genus *Paxillus*. The white spores, however, show that it is not referable to that genus. It may be called variety *paxilloides*.

Russula furcata (Pers.) Fr.

Ground in woods. Near Albany. July. An edible species.

Sarcoscypha rhenana Fckl.

Capular, stipitate or sessile, single or cespitose, often irregular, incurved on the margin when young, externally pruinose tomentose, pale yellow; hymenium pale yellow becoming orange tinted with age or in drying, sometimes slightly pruinose; stem short or almost none, when well developed whitened by a short downy tomentum; asci cylindric; spores elliptic, verrucose, .0008-.0009 of an inch long, .0004-.0005 broad, commonly containing one or two shining nuclei.

Cups 4-8 lines broad; stem 2-6 lines long, 2-4 thick. Decaying leaves and other vegetable matter in woods. Lake Pleasant. August. Its relationship is with *S. imperialis* from which it differs in the character of its spores and in its more highly colored hymenium.

Stereum burtianum n. sp.

PLATE O, FIG. 30-34

Pileus thin, submembranaceous, coriaceous, fibrous, subinfundibuliform, sometimes dimidiate, slightly uneven with radiating fibrous ridges, pallid with a slight cervine or rufescent tint, somewhat shining, the thin margin erect, spreading or decurved, slightly wavy or uneven on the edge and often incised or lacinate; hymenium even or slightly radiately uneven, decurrent, from pale buff to ochraceous buff; stem short, tough, solid, minutely tomentose or pruinose tomentose, subcinereous; spores minute, hyaline, even, globose or subglobose, .00012-.00016 of an inch broad.

Pileus 4-8 lines broad; stem 2-3 lines long, about half a line thick. Bare ground in bushy places. Shokan, Ulster co. September.

Sometimes the pilei of two or more plants growing close together are confluent. When well developed the pileus has a central stem, but sometimes one third or one half is wanting and then the stem is lateral though the pileus is usually erect. In such cases the pileus often appears as if perforate and the upper part of the stem as if hollow. This very distinct species is dedicated to Prof. E. A. Burt who has made a special study of the group of fungi to which it belongs and to whom I am under obligations for aid in the identification of some of the species.

Tricholoma subluteum n. sp.

PLATE O, FIG. 26-29

Pileus broadly campanulate becoming convex, umbonate, obscurely fibrillose, yellow, flesh white; lamellae close, emarginate, adnexed, white; stem equal or slightly tapering upward, solid, fibrillose, yellow, whitish at the pointed base, white within; spores globose, .0002-.00024 of an inch broad.

Pileus 2-4 inches broad; stem 3-4 inches long, 4-8 lines thick. Under coniferous trees. Lake Pleasant. August.

This is a beautiful but apparently a very rare species. It belongs to the second group of section *Sericella*. It is related to *T. chrysenterum* and *T. chrysenteroides*, but may be distinguished from them by its white flesh and lamellae.

Ulmaria rubra Hill.

Balfour place near Aiden Lair, Essex co. July.

The queen of the prairie has been introduced into our State from the West and is found in dooryards and flower gardens where it is cultivated for ornament. It sometimes escapes from cultivation or persists about the sites of old destroyed or abandoned dwellings. It is described in Gray's *Manual* under the name *Spiraea lobata*.

D

REMARKS AND OBSERVATIONS

Agastache scrophulariaefolia (Willd.) Kuntze

Roadside. Wells, Hamilton co. August. A showy form having purplish bracts and calyx lobes. It is sparingly pubescent and in this respect it approaches *A. nepetoides*, but it has the thicker spikes and more pointed calyx lobes of *A. scrophulariaefolia*.

Amanita muscaria formosa (G. & R.) Fr.

Several instances have been reported to me in which this variety of the fly amanita, a poisonous species, has been eaten without harm. In all these instances except one, the mushroom was eaten by those who were at the time ignorant or unsuspecting of its true relationship. In September, Mr A. P. Hitchcock of New Lebanon reported to me a case in which a sheep ventured to try the edible qualities of this mushroom. He says:

While I was gathering a few specimens of boletus in the pastures one evening last week, my cosset buck sheep, which follows me about like a dog, watched my proceedings with close attention for a time. Then, having assured himself of what I was doing he walked to a small group of the fly amanita, which grows luxuriantly in places in my fields, and proceeded to gobble down about a dozen fair sized specimens, eating the caps as greedily as he eats lump sugar from my hand. This was at least three days ago and perhaps more. He is still with us and in no way worse for his indulgence. Does this mean that I have mistaken some other sort for the fly amanita or that what is food for a buck sheep may be poison for a man? The amanita in question had the orange yellow color and the bulbous stem of *A. muscaria*.

In this as in all other cases of harmless eating of the fly amanita that have been reported to me the variety *formosa* is indicated.

The caps were either wholly or partly yellow. This is the common form in our State. It has the upper surface of the cap either wholly pale yellow or the center only tinged with red or orange, the margin remaining yellow. The form having the whole upper surface of the cap uniformly bright red or orange red is very rare with us. Yet this is the form commonly figured by European mycologists as *Amanita muscaria*. The form having the pale yellow cap was described by Gonnermann and Rabenhorst as a distinct species but Fries reduced it to a variety. The instances mentioned above are strong presumptive evidence of its harmless character and may be taken as another point of difference between this plant and the poisonous fly amanita. They strengthen the claims of those who have regarded the plant with the yellow cap as a distinct species. Still these two mushrooms are so closely allied in size, shape and structure that it does not seem prudent to regard them as distinct species and the yellowish capped one as edible, till full trial and investigation has established the fact beyond question.

Aster roscidus variifolius n. var.

Lower stem leaves ovate or oblong ovate, cordate, acuminate, serrate, petiolate, 2-5 inches long, upper stem leaves much smaller, oblong, entire, sessile or with a very short, widely winged petiole, scarcely more than 1 inch long.

Woods along the shore of Lake Ontario north of Mexico. September.

The whole plant is glandular. The three or four upper leaves are abruptly reduced in size.

Aster undulatus L.

A small form, 1.5-2 feet tall, with leaves ovate or subrotund, the lower petiolate, cordate and serrate with broad teeth, occurs near Minerva. It is related to *A. undulatus abruptifolius*, but is a much smaller plant.

Antennaria neglecta Greene

A dwarf form having the heads densely capitate, the stems of the pistillate plant only 2-4 inches long and of the staminate plant 2 inches or less, occurs at Minerva. It is in flower the first week

in May. In appearance it resembles the western *A. campestris* Rydb.

Boletus nebulosus Pk.

In State Museum report 51, page 292 a description of this species was published, but it was derived from mature specimens, no examples of the young plant having at that time been seen. Young specimens were found near Lake Pleasant in August. The pileus in them is hemispheric, soon becoming convex and is dark gray becoming brown with age. The tubes are at first closed and pallid or brownish. The stem is sometimes pointed at the base and varied above with pale streaks.

Cantharellus cibarius longipes n. var.

Pileus irregular, lobed or wavy on the margin, often centrally depressed and rimose squamose; lamellae very narrow, crowded, strongly decurrent, frequently anastomosing; stem long, its length equal to or exceeding the diameter of the pileus. In groves of spruce and balsam fir. North Elba. September.

Cortinarius amarus Pk.

A form of this species was found having the stem 2-3 inches long. It grows under spruce and balsam firtrees in North Elba, and is easily recognized by its small, irregular, yellow, viscid pileus and its very bitter flavor.

Dalibarda repens L.

Fine specimens of this pretty little plant were found by the roadside between Minerva and Aiden Lair. These have several short peduncles bearing mature seeds and one or two long ones now, July 24, bearing flowers. The early flowers were evidently clistogamic and very fruitful.

Eriophorum alpinum L.

Along the roadside 2 miles south of Aiden Lair. This little alpine cotton grass is rare in our State and it is interesting to find it maintaining itself along the side of a much used public highway.

Hydnum graveolens subzonatum n. var.

Pileus thin, nearly plane, slightly umbilicate, fibrously radiate striate, zonate with narrow, slightly darker zones, fuscous or grayish brown; aculei whitish.

North Elba and Lake Pleasant. August and September.

This northern variety agrees with the typical form in its mode of growth and in its odor, but differs from it in having the pileus more or less zonate and the spines of the hymenium whiter.

***Mnium affine ciliare* C. M.**

Catskill mountains. Mrs E. G. Britton. A fine variety readily known by the long ciliae or hairs that adorn the margin of the leaf.

***Otidea onotica* (Pers.) Fckl.**

Gregarious or cespitose, growing in damp shaded places on decaying wood and bark. North Elba. September. The base is sometimes whitened by mycelioid filaments. The receptacle is rather tough, but the more tender hymenium is sometimes eaten by insects or their larvae.

***Pilosace eximia* Pk.**

This rare little species is peculiar in having reddish spores. They are .00025 of an inch long, .00016 broad. The color of the spores appears to vary in the different species of this genus. In one they are described as black, in another as purplish brown. In structure the genus agrees with *Pluteus* of the pink spored series. At present it contains six species, two of which occur in Europe, two in the West Indies, one in Africa and one in the United States.

***Puccinia suaveolens* (Pers.) Rostr.**

This parasitic fungus may be classed among the useful species. It attacks the noxious Canada thistle and assists in keeping it in check by preventing it from producing seeds. But it also attacks another plant, *Centaurea cyanus*, blue bottle or bachelor's button, which is often cultivated for ornament. In this case also it prevents the development of the flowers and seeds and it may therefore be classed as an injurious fungus, since the flower is the special part for which the plant is cultivated. This plant escaped from cultivation at Menands and was growing like a weed in waste places. On these wild plants the fungus appeared in its uredo stage in May. Later in the season this was followed by the appearance of the teleutospores, the final stage, on the

same plants. The fungus on this host plant is designated form cyani.

Senecio vulgaris L.

The common groundsel is sometimes a troublesome weed in gardens. It begins to flower early in the spring and in wet seasons successive crops spring up and continue the production of seed till cold weather stops their growth. In poor soil it will flower when but two or three inches high, in rich soil it may grow 12 inches high and bear many branches. It grows rapidly and requires but a few days in which to develop from seed to maturity. The soil sometimes becomes so filled with its seeds that as fast as one crop of the plants is destroyed another takes its place.

Sisymbrium altissimum L.

The tall sisymbrium is an introduced plant which has proved to be quite troublesome as a weed in some of the northwestern states. The past summer it appeared in the vicinity of Albany. It was probably brought here either from the north or the west where it has become firmly established. By destroying such troublesome weeds when they first appear much future labor and trouble may be saved.

Solidago canadensis glabrata Porter

Generally the early goldenrod, *Solidago juncea*, is the first species to blossom in our latitude. It begins to flower in July, The past season, which is notable for its peculiar influence on some plants, seems to have hastened the time of flowering of some species. On July 24, *S. juncea*, *S. canadensis glabrata*, *S. arguta* and *S. rugosa* were all found growing near each other at North Creek and all were nicely in flower. The glabrate Canada goldenrod is a northern variety and perhaps in its effort to meet the requirements of the short northern seasons it has acquired the habit of blooming early.

Viola cucullata Ait.

In the cold bogs and wet places of the Adirondack region where this blue violet delights to grow, it is not unusual to find it with flowering scapes 6-9 inches long. The flowers much surpass the leaves, often standing twice as high. Such specimens were col-

lected in North Elba. Near Meadowdale a variety occurs in which the petals are variegated with blue and white. This variety has been observed there for several years and appears to be constant in its characters. I have also received specimens of it from other places and it seems strange that it has not been designated by name by some of those botanists who have made a special study of the violets.

Viola rotundifolia Mx.

Fine specimens of the round leaved yellow violet showing the branched peduncles of the clistogamic flowers were found by the roadside 2 miles south of Aiden Lair in July.

Viola selkirkii Pursh.

This pretty, but with us rare, little blue violet has disappeared from its former station in a pine grove near West Albany. It was found last spring in a grove of arbor vitae trees near Minerva, Essex co.

Xylaria grandis Pk.

Van Etten, Chemung co. W. C. Barbour. The specimens on which this species was founded were sent me by G. W. Clinton in 1872. No other specimens of the species had been seen by me till these came from Mr Barbour. They are smaller than the typical form and two of the three specimens sent have the clubs merely mucronate rather than acuminate. The radicating base is wanting in all the specimens, but it appears to have been broken off in collecting. The spores are of the same character as those of the type specimens and I have no doubt of the specific identity of the two fungi. It must be a rare species to escape a second discovery for 30 years.

E

EDIBLE FUNGI

Collybia acervata Fr.

TUFTED COLLYBIA

PLATE 84, FIG. 8-13

Pileus slightly fleshy, convex becoming expanded or nearly plane, glabrous, hygrophanous, pale tan color or incarnate red and sometimes obscurely striatulate on the margin when moist, whitish after the escape of the moisture; lamellae narrow, thin,

close, rounded behind, slightly adnexed or free, whitish; stem equal, hollow, glabrous, usually white tomentose at the base, reddish brown or purplish brown; spores white, elliptic, .00024-.0003 of an inch long, .00016 broad.

The tufted collybia is an inhabitant of the woods of our hilly and mountainous districts. It grows in dense tufts on decaying prostrate trunks of trees and among decaying leaves or on bits of rotten wood half buried by fallen leaves. The caps are rather thin and convex when young, but they expand with age and become broadly convex or nearly plane. When young and moist they are of a pale tan color or brownish red sometimes with a pinkish tint but as the moisture escapes they fade to a whitish color. In the European plant they are said to be umbonate but in the American plant the umbo is rarely present. The gills are quite narrow and close. They are rounded at the inner extremity and either slightly attached to the stem or quite free from it. They are whitish or slightly tinged with pink. The stem is rather slender, rigid but brittle, hollow and smooth except at the base where it is usually clothed with a white tomentum. The color is reddish brown or purplish brown but in the young plant it is often whitish at the top.

The cap is commonly 1-2 inches broad; the stem 2-3 inches long, 1.5-2.5 lines thick. The plants usually grow in clusters and occur during August and September. Though the individual plants are small they grow in such abundance that it is not difficult to obtain a sufficient supply for cooking. They are slightly tough but of good flavor and harmless.

Collybia familia Pk.

FAMILY COLLYBIA

PLATE 84, FIG. 1-7

Pileus thin, fragile, hemispheric or convex, glabrous, hygrophanous, while moist sometimes slightly striatulate on the margin, whitish, grayish or pale smoky brown, sometimes brownish or more highly colored in the center; lamellae thin, narrow, close, rounded at the inner extremity, nearly free, white; stem slender, glabrous, hollow, white or whitish, commonly with

a white villosity at the base; spores globose, .00016-.0002 of an inch in diameter.

The family collybia is similar to the tufted collybia in its mode of growth. It grows in similar localities but is limited in its habitat to decaying wood of coniferous trees. It is smaller and less frequent in occurrence but the tufts or clusters are generally composed of many more individual mushrooms. The caps are thin and fragile but are usually free from insect attack. They are whitish, grayish or brownish sometimes tinged with yellow but they have none of the reddish hues of the tufted collybia. In drying they are apt to become darker than when fresh. The gills are thin, narrow, crowded, white and free from the stem or but slightly attached to it. The stem is smooth, hollow and white or whitish, but like the pileus it becomes darker in drying. Sometimes it appears to be pruinously pubescent in the fresh plant when viewed with a lens. A wholly white variety very rarely occurs.

The cap is 6-12 lines broad; the stem 2-4 inches long, 1-1.5 lines thick. The time of its appearance is during July and August. Its edible qualities are similar to those of the tufted collybia from which it is easily separated by its smaller size and different color.

Russula mariae Pk.

MARY'S RUSSULA

PLATE 85, FIG. 1-8

Pileus at first nearly hemispheric, soon broadly convex, nearly plane or centrally depressed, pruinose and minutely pulverulent, dark crimson or purplish, sometimes darker in the center than on the margin, rarely striate on the margin when old, flesh white, pinkish under the cuticle, taste mild; lamellae moderately close, adnate, white when young, pale yellow when old; stem equal, solid or slightly spongy in the center, colored like or a little paler than the pileus, usually white at the top and bottom, rarely entirely white; spores pale yellow, globose, .0003 of an inch broad.

This russula is a beautiful and easily recognizable species, though somewhat variable in its colors. The cap is at first

nearly hemispheric, but it soon becomes convex and continues to expand till it is nearly plane or centrally depressed. The margin is even when young and generally remains so in maturity, but sometimes it becomes radiately striate. The surface appears to the naked eye to be pruinose or covered with a bloom, but under a lens it is seen to be dusted with minute particles which, under the action of water, are separable and give reddish stains to any white surface against which the moistened cap may be rubbed. This pruinosity is one of the best distinguishing features of the species. A little boy once went with his mother to look for mushrooms. They came on a group of Mary's russula and the little boy, noticing the bloom on the caps and recognizing in it a resemblance to the bloom of plums, cried out in childish glee "plummies, plummies." He was evidently a close and thoughtful observer and could distinguish at sight this russula from all others. The flesh of the cap is white, but has a pinkish tint immediately beneath the cuticle which is separable on the margin but adnate in the center of the cap. The taste is mild, but occasionally a specimen may be found in which it is slightly and tardily acrid. The color varies from deep crimson to purple. The center is sometimes more highly colored than the margin and in the purple specimens the margin in old plants is apt to fade to a whitish color and to become striate. The gills are white when young but with advancing age they become yellowish. They are nearly all of full length and are therefore wider apart at the margin of the cap than at the stem. A few are forked at the base and the interspaces are veiny. The stem is generally cylindric but occasionally tapering downward or pointed at the base. It appears to the naked eye to be smooth but under a lens it is slightly pulverulent. It is solid or slightly spongy and white within and colored like or a little paler than the cap externally except at the ends where it is white. Forms occasionally occur in which the stem is entirely white.

The cap is 1-3 inches broad; the stem 1-2 inches long, 3-5 lines thick. It grows both in woods and in open grassy places and is found in July and August. It is not as highly flavored as some

other russulas but I have no hesitation in placing it among the edible species.

Russula furcata (Pers.) Fr.

FORKED RUSSULA

PLATE 85, FIG. 9-14

Pileus convex becoming nearly plane, centrally depressed or funnel form, glabrous, even on the margin which is at first incurved, then spreading and acute, the thin adnate pellicle subseparable on the margin, greenish or brownish green, flesh white, taste mild; lamellae thickish, subdistant, often forked, with shorter ones intermixed, adnate or slightly decurrent, white; stem equal or nearly so, solid or spongy in the center, white; spores white, subglobose, .0003-.00035 of an inch long, .00025-.0003 broad.

The forked russula grows in woods and is a variable species. Two distinct European varieties have been described but our specimens do not fully agree with either of them nor with the typical form. The cap varies in color from a pale yellowish green or olive green to a dark brownish green, the center often being darker than the margin. Sometimes purplish hues are intermingled with the green, but these are apt to disappear from the dried specimens. The surface is slightly viscid when moist and sometimes it is rugosely roughened or reticulate in places. The margin, though thin, is not striate. The flesh is white and its taste mild. I have detected no bitter flavor to our form but the European form is said to have it. The gills are rather thick, moderately wide apart, persistently white and attached to the stem by their full width. Many of them are forked, the bifurcations occurring most frequently near the stem and the margin. There are also short gills which do not reach the stem. The interspaces are marked by transverse veins or ridges, but I do not find this character ascribed to the European form. The stem is nearly or quite cylindric, solid or when old somewhat spongy in the center, smooth and white.

The cap is 2-4 inches broad; the stem 1.5-3 inches long, 5-8 lines thick. It may be found in July. In my trial of its edible qualities it seemed more tough than some other russulas, but the

flavor was satisfactory and the species is deemed worthy of a place in our edible list even though the European plant has been published by some writers as poisonous.

Pholiota vermiflua Pk.

WORMY PHOLIOTA

PLATE 86, FIG. 13-20

Pileus convex or nearly plane, glabrous or occasionally floccose squamose on the margin, sometimes areolate rimose in the center, white, occasionally slightly tinged with yellow; lamellae close, adnexed, white becoming ferruginous brown, generally minutely eroded on the edge; stem hollow, equal, striated at the top, white, the annulus more or less floccose on the lower surface, lacerated or evanescent, white; spores elliptic, ferruginous brown, .0005 of an inch long, .0003 broad.

The wormy pholiota is closely related to the early pholiota, from which it may be separated by its larger size, thicker flesh, stouter stem, whiter color and the tendency of its pileus to crack into areas in the center. It is very liable to be infested by the larvae of insects and this is suggestive of the specific name.

The cap in the young plant is very convex or hemispheric but with advancing age it expands and becomes nearly or quite plane. The central part of the surface often cracks into areas giving it a scaly appearance. It also sometimes splits on the margin. It is smooth or occasionally slightly floccose scaly on the margin from the remains of the veil. The flesh is white. The gills are at first white but they become rusty brown with age. They are closely placed, excavated at the stem end and often whitish and minutely eroded on the edge. The stem is nearly cylindric, hollow, smooth, white and often striated at the top. Its collar is also white, somewhat floccose on the lower surface, often slight, lacerated and disappearing in mature plants, leaving the stem without a collar.

The cap is 2-4 inches broad; the stem 2-3 inches long, 3-5 lines thick. The plants are usually found in rich soil in grain fields, waste places and about manure piles and occur from June to August. When sound and well cooked the flavor is excellent and the mushroom is a fine addition to our table delicacies.

Psilocybe foenisecii (Pers.) Fr.

HAYMAKERS PSILOCYBE. MOWERS MUSHROOM

PLATE 86, FIG. 1-11

Pileus thin, campanulate or convex, obtuse, glabrous, hygrophalous, brown or reddish brown when moist, paler when dry; gills broad, adnate, minutely crenulate on the edge, ventricose, subdistant, brown; stem slender, nearly straight, hollow, rigid, fragile, glabrous, pruinose at the top, pallid or rufescent; spores brown, subelliptic, .0005-.0006 of an inch long, .00025-.0003 broad.

The haymakers psilocybe is a small but very regular, neat and attractive species which gets its name from its usual place of growth. This is in grassy places, on lawns or in meadows, where it is often destroyed by the mower while cutting grass. Its cap is conic or somewhat bell shaped when young, but it becomes more convex with age. When fresh and moist it is dark brown or reddish brown and is usually marked on the margin by darker parallel radiating lines. By the escape of the surplus moisture these lines disappear and the cap becomes paler, assuming a grayish or ashy gray color. The moisture generally escapes first from the center of the cap though the flesh is thicker there than on the margin. This gives a somewhat variegated appearance to the cap while the moisture is escaping, but after the evaporation is completed the color is nearly uniform. Sometimes the center of the cap has a reddish or tan colored hue, in which case this color is generally retained for a time after the escape of the moisture. The cap is generally brown in completely dried and shriveled specimens. The gills are rather broad, not crowded, somewhat narrowed behind and attached to the stem. They are pale brown when young, blackish brown when old. The stem is slender, usually long and nearly straight, hollow, easily broken and paler than the moist cap. It is sometimes tinged with red. The spores in our plant slightly exceed the dimensions given to the spores of the European plant.

The cap is 6-12 lines broad; the stem 2-3 inches long, about 1 line thick. This mushroom grows gregariously in rich grassy places, generally appearing in May and June. Sometimes it appears in great numbers and in successive crops, otherwise it would

be unimportant as an edible mushroom on account of its small size. It has been very abundant in the capitol lawn the last two seasons. It has not a very high flavor but it is harmless and relishable when fried in butter and may therefore be classed as an edible species, though some authors say that there are no edible species of *Psilocybe*. When uncooked its taste is strong and disagreeable.

Bovista pila B. & C.

ROUND BOVISTA

PLATE 84, FIG. 14-18

Peridium globose or subglobose, 1-3 inches in diameter, the outer coat very thin, at first smooth, white or whitish, soon breaking up into minute scurfy scales or becoming minutely rimose squamulose, finally disappearing and revealing the rather firm papery but persistent, tough, glossy brown inner coat; *capillitium* dense, persistent, brown; spores even, globose, .00016-.0002 of an inch broad.

The round *bovista* takes its specific name from its resemblance to a ball. It is quite globose and about 2 inches in diameter when well developed, but sometimes it is more or less irregular. When young it is white or whitish externally and pure white within. It is edible only while in this condition. As soon as the interior begins to change color it is no longer fit to eat and should be discarded. As it advances in age the surface or outer coat shrivels and breaks up into minute scales or scurf and after a time disappears. The inner coat is then smooth and tough like parchment. In maturity it is brown, purplish brown, seal brown or dingy coppery brown, sometimes shining and sometimes showing obscure patches of the exceedingly thin dried and brownish outer coat still adhering to it. It ruptures irregularly. The interior is then seen to be a dense towy and more or less dusty mass similar to the interior of a fully matured puffball. In this condition it often persists through the winter and may be found in fairly good condition for specimens after its hibernation. It grows either in woods, pastures or meadows and in suitable weather may be found from July to September.

F

NEW YORK SPECIES OF CRATAEGUS

The number of published species of *Crataegus* found in the United States and Canada has increased surprisingly within the last five years. In the edition of Gray's *Manual* issued in 1890, 10 species and three varieties are recognized as belonging to the territory covered by its flora. In the *Illustrated Flora* of Britton and Brown, the second volume of which contains the description of the species of this genus and which was issued in 1897, 15 species and three varieties are recognized, but the territory covered is somewhat larger than that of the *Manual*. Britton's *Manual* issued in 1901 increases the number to 31 species and retains but one variety. In the *Silva of North America*, volume 4, published in 1892, 14 species are described, but in volume 13, which appeared in 1902, the number of species is increased to 84 and the statement is made that this does not include some imperfectly known arboreous species nor the merely shrubby species. In the *Flora of the Southern States* by J. K. Small, issued in 1903, 185 species are described. Varieties are not recognized. In an article devoted to the species of *Crataegus* found in Rochester and its vicinity and published in the *Proceedings of the Rochester Academy of Science*, volume 4, 1903, C. S. Sargent has described 28 new species and recorded the occurrence of 13 others exclusive of two introduced species which occasionally escape from cultivation. This makes 41 species for the limited area of Rochester and its vicinity, a number greater than that given in Britton's *Manual* for the entire area covered by it two years ago. From these data the inference is scarcely avoidable that many of the recently described species must resemble each other closely and must be founded on slight variations of specific characters. If this inference is well founded, the conclusion is evident that such closely allied species can not be recognized without a thorough knowledge of their distinguishing characters and this knowledge can scarcely be obtained without careful study and close observation. To properly represent such species in the

herbarium, a set of good and well prepared specimens taken in the various stages of development from flowering time till the ripening and fall of the fruit, is required.

The genus *Crataegus*, as represented by our species, includes shrubs and trees which may be roughly but easily separated from species of other genera of the same family by the long spines or thorns with which their trunks and branches are armed. The common and local names applied to these plants are thorn, thorn apple, thorn bush, thorn tree, haw and hawthorn. They are nearly all suggested by this very prominent character of these plants. Some species are small shrubs, only 2 or 3 feet high with a basal stem diameter of scarcely 1 inch, others are trees 30 feet or more high with a basal diameter of the trunk of 1 foot or more. There is no well marked line of distinction between those which are classed as trees and those which should be called shrubs. They insensibly run together. The same species may be a shrub in one place and a tree in another.

The branches of many species are widely spreading giving a broad rounded head to the tree similar to that of an appletree. Often the lower branches spread horizontally and the upper diverge at a small angle giving a more conic outline to the top. The punctate thorn usually has most of its branches horizontally spreading. This gives it a broad, flattened or depressed head and makes the species easily recognizable at a distance. The shrubby species branch from the base and when several clumps grow near each other they form almost impenetrable thickets. The young shoots of the branches are at first green but with advancing age the upper surface gradually assumes a reddish brown or other color which later encircles the whole shoot. During the second or the second and third years the color becomes, in most species, some shade of gray or ashy gray.

The spines that grow from the trunk and branches are modified or peculiarly developed branches. They are themselves sometimes branched and generally they agree in color with the branch to which they are attached. They usually have a bud at one side of the base and sometimes one on both sides. These buds develop

into a leaf, a branch or a cluster of flowers the next year. In breaking a spine from its branch the leaf, branchlet or flower cluster is likely to be torn away with it unless care is taken to avoid it. The young spine is often adorned with one or more narrow foliaceous bracts which are quickly deciduous. The spines of the hawthorn are sometimes elongated and leaf bearing. They then appear like a short leafy branch terminating in a sharp leafless point.

The leaves are alternate and simple but generally more or less distinctly lobed and serrated on the margin. Those of young and vigorous shoots often differ from others on the same tree in size, shape and lobing. The teeth of the margin are nearly always tipped with glands which may vary in color in different species. The teeth themselves vary according to the species. They may be short or long, narrow or broad, blunt or sharp pointed, straight or incurved. The surface of the leaf blades may be smooth, pubescent or scabrous. In many species the upper surface of the young leaves may be coated with deciduous hairs which soon disappear leaving the surface of the mature leaves glabrous. The lower surface is generally paler than the upper. In some species the young unfolding leaves are tinged with brownish red or bronze red but they become green with advancing age. The leaves are normally petiolate and stipulate but the stipules soon disappear and in some species the petioles are short and so widely margined by the decurrent leaf blades that the leaves appear to be sessile. The petioles are often furnished with a few glands which may be either sessile or stalked. They are often more highly colored when old than when young, and are apt to be shorter on vigorous shoots than on fruiting or lateral branches. In general outline the leaf blades may vary in different species from oblanceolate or spatulate to obovate, ovate, oblong ovate, elliptic, oval or orbicular.

The buds are compact and globular with very broad blunt scales. In some species they are covered with a varnish which becomes sticky in warm weather. When they burst in spring the inner scales enlarge rapidly, become elongated and assume pink

reddish or yellowish hues. They are glandular on the margin and in some species on the surface also. These scales are generally soon deciduous.

The flowers in our species are, with one exception, *Crataegus uniflora*, produced in clusters at the ends of short leafy terminal or lateral branches. In the earliest species to flower in our latitude they appear about the end of the first week in May, in the latest, the first week in June, making the flowering season about one month long. In nearly all cases the flowers open and their petals fall before the leaves are fully developed. The flower stems or peduncles may be long or short, simple or branched, glabrous or hairy, according to the species. The branching peduncles frequently support three flowers each, the central flower opening a little earlier than the two lateral. The calyx is superior and five lobed, the petals are five, the stamens vary from 5 to 20 and the pistils from 1 to 5. The stamens are normally 5, 10, 15 or 20 in any given species, but by the suppression of some or the union of two adjacent filaments such definite numbers are not always found. Nevertheless the number of the stamens is now utilized as a specific character. The color of the anthers may be pale yellow or whitish, pink or rosy red, purplish red or violaceous, and though these colors are very fleeting they are recognized as having, in many cases, specific value. The calyx lobes are generally tipped with a single gland, their margins may be entire or furnished with sessile or stalked glands. They are erect in bud but spreading or reflexed in anthesis and in some species they later become again erect or incurved. In many species they also become red on the inner basal surface as they advance in age. They are sometimes deciduous from the ripe fruit, specially in species belonging to the section *Tomentosae*. The petals are nearly always white in our species. In one or two they show a tendency to become rosy tinted when they begin to wither. They are quickly deciduous. They are sometimes eroded or wavy on the edge, and are generally furnished with a short claw at the base.

The time of ripening of the fruit extends from the middle of August to the middle of October. The number of fruits in any

cluster is generally less than the number of its flowers because some flowers fail to produce fruit. The fruit may be globose, oval, oblong, ovate or pyriform. It is not invariably of the same size and shape on the same tree but it is now thought to furnish characters of specific value. When the flower stem is short and stout the ripe fruit is likely to be erect. If the flower stem is long and slender the ripe fruit is likely to droop on its stem. In some species the hairiness of the calyx tube of the flower persists and the fruit is hairy, in others it disappears and the fruit is smooth. In some the fruit falls when it is ripe or soon after, in others it hangs on the branches after the leaves have fallen, persisting sometimes till winter or in rare cases and partially till the following spring. In most species the color of the ripe fruit is some shade of red, either orange red, scarlet, vermilion or crimson. In some it is yellow, greenish yellow, or these colors varied with a red cheek. In some species the fruit has a distinct pruinosity or bloom, in others an indistinct or scarcely noticeable bloom is present. Such fruits have a dull or opaque color but a little rubbing of the surface brings out a shining color. The cuticle in some species may be stripped from the fully ripe fruit as from a very ripe peach or pear. The flesh or pulp in some is dry and mealy, in others juicy and soft. It may be whitish, greenish yellow, orange or red. In many species the fruit has an agreeable flavor and is sweet or slightly acid and edible. In some cases it has been utilized in making jelly. In size it varies much, being but three or four lines in diameter in some and nearly an inch in others. In most of our species it is from five to seven lines in diameter. The number of nutlets of the fruit generally equals the number of styles in the flower. In the section *Tomentosae* the nutlets differ from those of the other sections in having the inner faces excavated. Thorn bushes appear to have in some cases their "off years" like apple-trees. A bush may be loaded with fruit one year and the next have none. Sometimes the fruit fails because of late frosts. This happened about Lake Placid the past season. A severe frost the last week in May killed the stamens and pistils even in the unopened flower buds, and though the petals were apparently

unharméd and the flowers appeared as usual at a distance, the essential organs having been killed, no fruit developed.

Cattle sometimes browse on the twigs of thorn bushes. In such cases the injured branches put forth many new shoots which are short and dense and form an almost impenetrable surface growth. If the bush is low enough to be browsed from top to bottom it gradually assumes a conic shape. If it is so tall that cattle can not reach the ends of the upper branches these continue their normal growth and the lower part of the bush assumes a conic shape and the dense ramification. The whole bush then appears somewhat like two cones with their vertices united, the lower with its vertex pointing upward, the upper with its vertex pointing downward as in an hourglass. This behavior of thorn bushes under the pruning given them by browsing cattle indicates their suitability for hedges.

Herbarium specimens of species of this genus should be collected at three different times. The first collection should be made when the plant is in flower. This collection will show the characters of the flowers, of the young shoots and of the young and unfolding leaves. The second should be made when the leaves have become fully developed. This will show the character of the mature leaves and of the young fruit. The leaves at this time are in much better condition than late in the season when the fruit is ripe. At this time it is also well to collect specimens of the young vigorous shoots, since the leaves on these are often larger and differ more or less in shape from those on older and less vigorous lateral or fertile branches. The third collection should be made when the fruit is ripe. Its object should be to get this in as good condition as possible. Insect larvae and parasitic fungi often injure and deform the fruit and it is well to select as far as possible such specimens as are most free from these pests. Sometimes nearly every fruit on a shrub or tree is found to be injured by them. In some species the fruit ripens very late. In such cases the leaves are ready to fall or have already partly fallen when the fruit is ripe. Specimens bearing ripe fruit should not be severely pressed lest the fruit be crushed. It is well to dry

some of the fruit without pressing. It is important that the three collections be made from the same tree or shrub in order to avoid the danger of confusing two or more closely related species. Sometimes two or more species grow together in one clump and in such cases special care is necessary lest the intermingled branches lead to inextricable confusion of species. To guard against any slip of memory it is well to mark the trunk of every tree or shrub from which specimens are taken, giving to each a number corresponding to a number attached to the specimens taken from it. With a pocket knife shave the rough bark from a small place on one side of the trunk and inscribe the number on this smooth place. It is well in every case to select the same side of the trunk, for example, the north side. Then no time need be lost in looking for the mark on the other sides.

Because the branches are often coarse and crooked and armed with stout spines, strong pressure is necessary to make good herbarium specimens of them. A screw press is recommended for this purpose. It is also well to loosen the spines by partly splitting them from the branch before putting the samples in press. It is desirable to know the date of each collection. It should therefore be recorded on the ticket.

PRUINOSAE

Fruit medium, red when ripe, pruinose; stamens 10-20; leaves thick or subcoriaceous, commonly bluish green, glabrous when mature.

The pruinosity of the unripe fruit is one of the most available characters by which to recognize the species of this group. The two species here described differ in the number of their stamens and the color of their anthers.

Stamens 20, anthers pale yellow or whitish	<i>C. conjuncta</i>
Stamens 10, anthers pale purple or pink	<i>C. dissona</i>

Crataegus conjuncta Sarg.

Conjoined thorn

Rhodora, 5:57

Large shrub 8-12 feet tall with widely spreading or ascending branches; leaves ovate, broadly ovate or oval, acute or subacu-

minate at the apex, rounded or slightly cuneate at the base, or on vigorous young shoots larger, truncate or slightly concave cuneate, sometimes broader than long, sharply and unequally serrate, generally with 3-4 short, acute or sharp pointed lobes each side, glabrous, yellowish green, 1-2 inches long and nearly as broad at flowering time, larger, thicker and bluish green above when mature, pale below, petioles slender, 6-15 lines long, usually slightly margined and bearing a few scattered glands; inflorescence glabrous, flowers 5-10 in a cluster, peduncles 6-10 lines long, stamens 20, anthers pale yellow or whitish; fruit globose or depressed globose, somewhat angular, often broader than long, pruinose, erect or drooping, red when ripe, crowned by the incurved, spreading or reflexed, persistent calyx lobes, nutlets 4-5.

Clayey hillsides. Albany and North Greenbush. Flowers from the middle to the end of May, fruit ripens from the first to the middle of October and falls gradually, but sometimes a few fruits hang on the branches all winter. The unfolding leaves are sometimes tinged with brownish red. On young and vigorous shoots the basal pair of leaf lobes are sometimes larger and more widely spreading than the others.

***Crataegus dissona* Sarg.**

Dissonant thorn

Rhodora, 5: 60

Shrub 6-10 feet tall with widely spreading or nearly erect branches; leaves ovate, broadly ovate or rhomboidal, 1-1.5 inches long and nearly as broad at flowering time, thin and yellowish green, acute or sharp pointed at the apex, rounded or broadly cuneate at the base, often tinged with brownish red as they unfold, sharply serrate, with 3-4 slight, acute or sharp pointed lobes each side, glabrous, larger, firmer and bluish green above when mature, paler below, those on vigorous young shoots larger and often truncate at the base, sometimes with the basal pair of lobes enlarged, petioles slender, 6-12 lines long, often slightly enlarged and glandular at the top; flowers on slender glabrous peduncles, 5-8 in a cluster, stamens generally 10, sometimes 7-9, anthers pale purple or pink; fruit globose or depressed globose, pruinose, dark

red or crimson when ripe, the boat-shaped calyx lobes erect or spreading, their tips often deciduous, nutlets 3-5.

Clayey soil. Albany, Copake, Lansingburg and Thompsons Lake. Flowers about the middle of May, fruit ripens from the first to the middle of October. Distinguished from the preceding species by its fewer stamens, pink or purplish anthers and crimson fruit. *C. pruinosa* differs from both in having 20 stamens with pink anthers. It is a common species about Albany.

INTRICATAE

Fruit medium, yellowish green, orange red or crimson, nutlets 2-5, ridged on the back; corymbs few flowered; leaves thick, subcoriaceous.

Small, rather late flowering shrubs.

Leaves hairy when young 1

Leaves glabrous *C. intricata*

1 Anthers pink or pinkish purple *C. peckii*

1 Anthers pale yellow *C. modesta*

Crataegus intricata Lange

Intricate thorn

Small shrub 3-8 feet tall with few erect or spreading branches; leaves ovate, broadly ovate, elliptic or oblong elliptic, thin when young, becoming thick and firm with age, acute at the apex, broadly rounded or cuneate at the base, sharply serrate, with 3-4 acute lobes each side, the basal pair, on leaves of young vigorous shoots, often enlarged and distinctly separated from the pair above by deep sharp excavations, glabrous both sides, petiole slender, 4-12 lines long, glandular, slightly margined at the apex; flowers in clusters of 4-8, on short, mostly glabrous peduncles, calyx lobes lanceolate, slightly lacinate serrate, stamens 5-10, anthers pale yellow; fruit erect, subglobose or obovate, pointed at the base, pale red or orange red, nutlets 3-4.

Hillsides and shaly knolls. Albany and Lansingburg. Flowers May 20 to June 1, fruit ripens the last week in September and the first week in October, and soon falls. In falling it often carries the peduncle with it. The spines are slender, straight or nearly so and usually 1-1.5 inches long.

Crataegus modesta Sarg.*Modest thorn*

Rhodora, 3:28

Small shrub 2-5 feet tall with irregular short branches; leaves broadly ovate, ovate or oblong ovate, acute at the apex, rounded or cuneate at the base, on young and vigorous shoots often truncate or slightly cordate, serrate, with 3-4 short, broad, acute lobes each side, at flowering time pale green and hairy above, paler and villose below, specially on the midrib and principal veins, when mature thick and firm, dark green and scabrous above, much paler below, 1.5-2 inches long, 1-1.5 broad, petioles 4-12 lines long, glandular, villose, margined at the apex, sometimes on vigorous shoots nearly to the base, often becoming red with age; flowers large, 3-6 in a cluster, on short, villose, mostly simple, peduncles, calyx tube hairy, its lobes slightly hairy, laciniate serrate, reflexed in flower, stamens 10, anthers pale yellow; fruit erect, subglobose, short oblong or pyriform, greenish yellow, orange red or greenish with a red cheek, hairy, nutlets 3.

Clayey and shaly soil. Albany, Rensselaer and Lansingburg. Flowers open the last week in May or the first week in June, fruit ripens late in September. The spines are variable, being slender or stout, straight or curved, and 1-1.5 inches long. On some clumps they are very scarce. The young shoots are more or less villose.

Crataegus peckii Sarg.*Peck's thorn*

Rhodora, 5:63

Small shrub 2-6 feet tall, sparingly branched; leaves ovate or broadly ovate, acute at the apex, broadly rounded or concavely cuneate at the base, on young and vigorous shoots often truncate, serrate, divided into 3-4 short, broad, acute or blunt lobes each side, when young, hairy above with appressed whitish hairs, villose below on the midrib and principal veins, when mature, firm, dark green and scabrous above, much paler below, the basal pair of lobes often much enlarged and more distinct, 1.2-2 inches long, nearly as broad or on young vigorous shoots 2-2.5 inches long; flowers large, 3-6 in a cluster, supported on short, villose, simple peduncles,

calyx tube glabrous, its lobes glabrous, laciniate serrate above the middle, stamens 10, anthers pink or pinkish purple, filaments usually white; fruit erect on short slightly villose peduncles, subglobose or short oblong, glabrous, yellowish green when ripe, the calyx lobes mostly deciduous, nutlets 3-4.

Shaly soil. Lansingburg. Flowers the last week in May or the first week in June, fruit ripens early in October and soon falls. The species is closely related to *C. modesta* from which it may be separated by its mostly broader leaves, its less hairy inflorescence, pink or pinkish purple anthers and glabrous yellowish green fruit. In this as in the two preceding species the fruit is crowned by a prominent rim which surrounds the calyx cup. The spines are slender, straight or slightly curved and 1.2-2.5 inches long.

MOLLES

Fruit, large, bright red and shining when ripe, often hairy, specially when young; inflorescence villose tomentose; leaves large, broad, softly hairy when young.

The three species here recorded are trees or large shrubs with edible fruit.

Anthers pale yellow or whitish *C. champlainensis*

Anthers pink, dark red or purple 1

1 Leaves often convex, calyx lobes hairy on the
inner surface

C. pringlei

1 Leaves plane, calyx lobes hairy on both surfaces *C. exclusa*

Crataegus champlainensis Sarg.

Champlain thorn

Rhodora, 3:20. Silva N. A. 13:105, t. 669. N. Y. State Mus.

55th An. Rep't, p.944

Tree or large shrub 10-20 feet tall with widely spreading branches; leaves ovate or broadly ovate, 2-2.5 inches long, 1.5-2 broad at flowering time, larger when mature and on vigorous young shoots, acute at the apex, rounded, truncate, broadly cuneate or slightly cordate at the base, slightly and sharply lobed, coarsely and sharply serrate, when young pubescent above with whitish appressed hairs, pubescent beneath and villose on the

midrib and principal veins, petioles villose and glandular; corymbs commonly few flowered, peduncles and calyx covered with long matted whitish hairs, stamens 10, anthers pale yellow or whitish; fruit oblong obovate or subglobose, often narrowed toward the base, bright red or scarlet, 7-8 lines long, 6-7 broad, nutlets 3-5.

Clayey soil. Port Henry, Crown Point, Fort Ann, Albany. The trees found in the vicinity of Albany differ from those found in the more northern localities in having broader and more rounded leaves, which are sometimes blunt at the apex and often have the margin coarsely wavy, curved or arched as if there was an excessive development of the lateral tissues. The anthers are whitish, not pale yellow as in the type, and the fruit is globose or oval, slightly umbilicate and persistently hairy. It is the first species to blossom about Albany, the flowers appearing from May 10-15, and the fruit ripens and falls early in September. Perhaps these trees belong to a distinct species. The trees in the Fort Ann locality have recently been cut down.

***Crataegus pringlei* Sarg.**

Pringle's thorn.

Rhodora, 3:21. Silva N. A. 13:111, t. 672. N. Y. State Mus.
55th An. Rep't, p. 944

Tree or large shrub 12-25 feet tall with widely spreading branches and a broad rounded head; leaves broadly ovate or oval, 1-2 inches long and nearly as broad at flowering time, acute or bluntly pointed at the apex, subtruncate or broadly cuneate at the base, coarsely and sharply serrate, with 3-4 short broad acute lobes each side, pubescent above with short appressed whitish hairs, slightly villose below on the principal veins and midrib, yellowish green above, paler below, often convex by the deflection of the margins, petioles slender, villose; corymbs few flowered, stamens 5-10, anthers pink or pinkish purple, calyx lobes hairy on the inner surface, peduncles short, villose; fruit subglobose, oval or oblong, sometimes slightly narrowed toward the base, generally hairy at the ends, 6-7 lines long and nearly as broad, bright red or scarlet, the calyx lobes spreading or erect.

Clayey soil. Albany and Albia, Rensselaer co.

When in flower the colored anthers easily separate this species from the preceding one, later it may be recognized by the convexity of many of the leaves. The young unfolding leaves are sometimes tinged with red. On vigorous young shoots the leaves often have the basal pair of lobes somewhat enlarged and more distinct than the others.

***Crataegus exclusa* Sarg.**

Excluded thorn

Rhodora, 5: 108

Shrub 8-12 feet tall, with widely spreading or ascending branches; leaves similar to those of the preceding species but without the convexity seen in them; flowers similar but the calyx and peduncles more densely villose or tomentose, the calyx lobes more narrow, elongated and hairy on both surfaces; fruit longer and more narrowed toward the base.

Clayey soil. Crown Point and Fort Ann. May, September.

Formerly united with *C. pringlei* but separated from it because of its more shrubby habit, more hairy inflorescence and longer fruit.

DILATATAE

Fruit medium or large, subglobose, bright red or scarlet, nutlets 5, ridged on the back; flowers having 20 stamens with rose colored anthers; leaves broad, thin.

***Crataegus dilatata* Sarg.**

Broad leaved thorn

Bot. Gaz. 31: 9. Silva N. A. 13: 113, t. 673

Tree or large shrub 10-20 feet tall with widely spreading or ascending branches and a broad rounded head; leaves thin, ovate or deltoid ovate, acute at the apex, subtruncate or slightly cordate at the base, with 4-6 short, acute or sharp pointed lobes each side, serrate with unequal sharp pointed teeth, when young minutely pubescent above with short, stiff, appressed, whitish hairs, glabrous below or with a few hairs on the midrib and in the axils of the principal veins, 1.5-3 inches long when mature, nearly as broad, those of vigorous young shoots often with the basal pair

of lobes enlarged and more distinct, petioles slender, 8-18 lines long, slightly villose in the furrow when young, distantly glandular, often reddish toward the base, becoming more red with age, this color sometimes extending to the midrib and principal veins; corymbs 6-10 flowered, peduncles slightly hairy or glabrous, rather long, stamens 20, anthers rose color, calyx tube slightly hairy, its lobes glandular serrate, hairy on the inner surface; fruit globose or oval, 6-8 lines long, 6-7 broad, umbilicate at the base, drooping, bright red, nutlets 4-5, flesh yellowish, well flavored, edible.

Clayey soil. Flowers the last week in May, fruit ripens in September. Thompsons Lake, Albany co. and Gansevoort, Saratoga co. In the latter locality it forms a tree 15-20 feet tall with a trunk diameter of 4-6 inches. On some trees the fruit is globose, on others it is oval. The leaves sometimes become convex as in *C. pringlei*. The fruit stems sometimes become red in the upper part.

LOBULATAE

Fruit medium or large, subglobose or oblong, bright red or crimson, nutlets 3-5, distinctly grooved on the back; inflorescence villose or glabrous, stamens 5-15, anthers rose color.

Leaves glabrous beneath, stamens 5-8 *C. holmesiana*

Leaves somewhat hairy beneath, stamens 5-10 *C. lobulata*

Crataegus holmesiana Ashe

Holmes thorn

Bot. Gaz. 31: 10. Silva N. A. 13: 119, t. 676

Tree or large shrub 12-25 feet tall with widely spreading or ascending branches; leaves thin, ovate, 1-1.5 inches long, 9-15 lines broad at flowering time, larger and firmer when mature and on vigorous young shoots sometimes with the basal pair of lobes enlarged and more divergent, acute at the apex, broadly rounded or subtruncate at the base, sharply serrate with slender pointed teeth, with 4-5 short acute lobes each side, pubescent above when young with minute appressed whitish hairs, glabrous and slightly paler below, petiole slender, 6-12 lines long, glabrous or with a few hairs and reddish glands; flowers 8-12 in a cluster, 5-8 lines broad, on slender, glabrous or slightly hairy peduncles, calyx glabrous, often tinged with red, the lobes narrow, linear, slightly

glandular, stamens generally 5, sometimes 5-8, anthers purple; fruit subglobose, oblong or obovate, generally narrowed toward the base, bright red or crimson, crowned with the persistent, erect or incurved calyx lobes, nutlets 3-5, flesh yellow.

Clayey soil. Crown Point, Fort Ann, Thompsons Lake and Albany. It flowers from May 15-25, fruit ripens the last week in August and the first week in September. The foliage is commonly yellow green, but it is sometimes dark green.

***Crataegus lobulata* Sarg.**

Lobulate thorn

Rhodora, 3:22. Silva N. A. 13:117, t. 675

Tree 15-30 feet tall and a trunk diameter of 6-12 inches; leaves oval, ovate or oblong ovate, at flowering time 1.5-2.5 inches long, 1-2 broad, larger when mature, pubescent with soft appressed whitish hairs above, slightly hairy below, specially on the midrib and principal veins, acute at the apex, rounded or broadly cuneate at the base, sharply serrate, with 4-5 sharp pointed distinct lobes on each side, petioles slender, loosely villose or tomentose, 1-1.5 inches long, becoming reddish or tinged with red in maturity; flowers on slender, villose or tomentose peduncles, the calyx often hairy below and its lobes hairy on the inner surface, stamens usually 10, sometimes 5-10, anthers reddish purple; fruit oblong or subglobose, crowned by the persistent erect or incurved calyx lobes, when ripe, crimson, 6-8 lines long and nearly as broad, nutlets 3-5, flesh yellow, edible.

Clayey soil. Crown Point. It blossoms from the 20th to the end of May and ripens its fruit late in September. Its foliage is yellowish green. It is closely related to the preceding species from which it may be separated by its larger size, the hairiness of the lower surface of the leaves, the more hairy inflorescence, more numerous stamens and its later ripening fruit.

FLABELLATAE

Fruit medium, scarlet or dark red, nutlets 3-5, ridged on the back; stamens 10-20; leaves membranaceous but firm when mature.

Anthers pink or purplish

C. contigua

Anthers pale yellow or whitish

C. irrasa

Crataegus contigua Sarg.*Contiguous thorn*

Rhodora, 5: 115

Shrub 6-10 feet tall with spreading or ascending branches; leaves thin, ovate, acute or acuminate at the apex, rounded or broadly cuneate at the base, serrate, with 4-5 distinct, sharp pointed or acuminate lobes each side, at flowering time pale green and clothed above with short appressed whitish hairs, glabrous below, when mature, firm, dark green above, paler below, 1.5-2.5 inches long, 1-2 broad, petioles slender, glabrous, slightly glandular, 6-12 lines long; flowers on slender glabrous peduncles, calyx lobes abruptly narrowed from broad bases, linear, entire or with occasional glands toward the base, stamens 20, anthers purple or pinkish purple; fruit erect or drooping, subglobose or oblong, scarlet, flesh yellow, nutlets 4-5.

Shaly soil near Lansingburg. Flowers open about the middle of May, fruit ripens early in September and soon falls. In our plants the flowers open and the fruit ripens two or three weeks earlier than in the type and the number of stamens ranges from 12-19. In no case have I found a flower with 20 stamens. Nevertheless these variations do not seem to be of sufficient importance to warrant a separation of the plants. The unfolding leaves are tinged with brownish red.

Crataegus irrasa Sarg.*Unpolished thorn*

Rhodora, 5: 116

Shrub 6-12 feet tall with numerous slender spreading or ascending branches; leaves thin, ovate or oval, acute at the apex, cuneate at the base, lacinate serrate, when young clothed above with appressed whitish hairs, villose below on the midrib and principal veins, when mature firm, dark green and shining above, paler or yellowish green below, petioles 6-12 lines long, slender, slightly margined at the apex, sparingly glandular; flowers 6-7 lines broad, supported on villose peduncles, calyx tube densely villose, its lobes lanceolate, glandular serrate, villose, reflexed, appressed, stamens 20, anthers pale yellow; fruit subglobose or oblong, dark red, nutlets 4-5.

Clayey soil. North Greenbush. The plants which are here referred to this species diverge so much from a rigid agreement with the description of the species to which we have referred them that it seems best to consider them a variety which may be called *var. divergens*.

It is characterized as follows:

Leaves oval, serrate with blunt gland-tipped teeth, divided above the middle into 4-5 short narrow strongly pointed lobes each side, petioles villose; corymbs 5-10 flowered, stamens 10-18, anthers whitish; fruit globose or oval.

The young shoots are villose tomentose. The flowers open about the middle of May and the fruit ripens the last week in August or early in September, which is two or three weeks earlier than in the type. Only a single clump of this shrub was found. It approaches *C. densiflora* in its characters but differs from it in its more numerous stamens and in having the lower surface of the leaves hairy on the midrib and principal veins.

TENUIFOLIAE

Fruit medium, oblong, pyriform or subglobose, crimson or scarlet, nutlets 2-5; inflorescence glabrous or nearly so, stamens 5-20, anthers pink, rose color or dark red; leaves membranaceous, generally pubescent on the upper surface when young, glabrous or scabrous when mature.

The three species here recorded may be tabulated as follows:

Leaves ovate or oblong ovate	<i>C. ascendens</i>
Leaves ovate, oval or rhomboidal	1
1 Calyx lobes hairy on the inner surface	<i>C. matura</i>
1 Calyx lobes glabrous on the inner surface	<i>C. delucida</i>

Crataegus ascendens Sarg.

Ascending thorn

Rhodora, 5: 141

Shrub 6-10 feet tall with slender ascending branches bearing short, straight or slightly curved spines rarely more than an inch long; leaves thin, ovate or oblong ovate, at flowering time 1.5-2 inches long, 8-15 lines broad, acuminate at the apex, rounded or cuneate at the base, finely and sharply serrate, with 4-5 acuminate

lobes each side, often tinged with brownish red as they unfold and clothed above with minute appressed whitish hairs which soon disappear, dark yellowish green above, paler below, larger, darker green and glabrous when mature, petioles slender, 9-15 lines long, dotted with a few scattered glands and slightly margined at the apex; flowers 6-12 in a cluster, on slender rather long glabrous peduncles, calyx lobes narrow, elongated, entire or with a few minute glands, stamens 5-10, anthers pink or pinkish purple; fruit subglobose obovate or oblong, dark red when ripe, drooping, the calyx lobes subsistent, spreading or reflexed, nutlets 3-4.

Clayey soil. North Greenbush and Rensselaer. Flowers May 12-20, fruit ripens during September. This species is very distinct and easily recognized by its peculiar oblong ovate leaves with acuminate apex and on fertile branches with cuneate base, making them pointed at each end. On young and vigorous shoots they are usually broadly rounded at the base, and are sometimes 3.5-4 inches long and 2-2.5 inches broad. They are generally more elongated when growing in the borders of woods than when in more open exposed places. The autumn buds are clothed with a varnish which is sticky in warm weather. Though found in several places on the east side of the Hudson river, no example of it has yet been found on the west side of the river.

Crataegus matura Sarg.

Mature thorn

Rhodora, 3: 24

Shrub 5-10 feet tall with many slender ascending or nearly erect branches or occasionally with the lower widely spreading; leaves broadly ovate, oval or rhomboidal, thin, acute or acuminate at the apex, rounded or cuneate at the base, finely and sharply serrate, deeply and sharply divided into 4-6 very distinct sharp pointed or acuminate lobes on each side, yellowish green when young and clothed with short appressed whitish hairs, darker green and glabrous when mature, 2-2.5 inches long, 1.5-2 inches broad, petioles slender, 6-12 lines long, slightly glandular and sometimes wing margined at the apex; flowers 4-8 in a cluster, on short glabrous or slightly hairy peduncles, calyx lobes elongated, narrow, entire or slightly glandular, often red at the tips,

slightly hairy on the inner surface, becoming bright red at the base, stamens usually 10, sometimes 5-9, anthers red or reddish purple; fruit subglobose or oval, about 6 lines long, 5-6 broad, dark red or crimson, nutlets 2-5, flesh yellow, pleasant, edible.

Clayey soil and rocky pastures. Gansevoort, Saratoga co. and Lake Pleasant, Hamilton co. Flowers in May, ripens its fruit the latter part of August.

The early ripening of the fruit is one of the distinguishing characters of the species. In our specimens the fruit is scarcely oblong as in the typical form, and the styles are 2-3, but in other respects the agreement of the characters is good. The bright red color of the inner bases of the calyx lobes in the Gansevoort specimens contrasts beautifully with the pale green color of the immature fruit.

***Crataegus delucida* Sarg.**

Delucid thorn

Rhodora, 5: 139

Shrub 6-10 feet tall with erect or ascending branches; leaves thin, ovate, broadly ovate or oval, acute, sharp pointed or acuminate at the apex, broadly rounded, subtruncate or rarely broadly cuneate at the base, finely serrate, with 4-6 distinct, sharp pointed or acuminate lobes each side, generally tinged with bronze red when they unfold and then covered above with short appressed whitish hairs, at flowering time yellowish green, 1-1.5 inches long, 9-18 lines broad, paler and glabrous below, larger, darker green and glabrous above when mature, petioles slender, 6-12 lines long, usually shorter on young and vigorous shoots with the blades larger and broader, slightly glandular; flowers 6-12 in a cluster, about 6 lines broad, on slender branched glabrous peduncles, calyx lobes narrow, elongated, entire or with few minute glands, often red at the tips, stamens usually 5-8, sometimes 10, anthers red or reddish purple; fruit oblong, bright red or scarlet, drooping, the calyx lobes spreading or reflexed, often deciduous from the ripe fruit, nutlets 3-4, flesh yellow.

Clayey hillsides and rocky pastures. Albany and Sandlake. Flowers about the middle of May, fruit ripens during the last half of September or early in October.

This is one of the prevailing species on the hillsides north of Albany. The flowers have a strong potash odor. It is closely related to *C. acutiloba* Sarg. with which it was formerly united, but its flowers are smaller and its nutlets more numerous.

COCCINEAE

Fruit medium, subglobose, crimson or scarlet when ripe, nutlets 2-5, distinctly ridged on the back; leaves thin or subcoriaceous.

Anthers pale yellow or whitish

C. gravesii

Anthers purple or red

1

1 Stamens 20

C. brainerdi

1 Stamens 10

C. praecoqua

1 Stamens less than 10

C. egglesoni

Crataegus gravesii Sarg.

Graves thorn

Rhodora, 5: 159

Shrub or small tree with widely spreading or ascending branches; leaves ovate, obovate, elliptic or subrotund, thin, acute or rounded at the apex, rounded or cuneate at the entire base, unequally serrate with rather broad blunt teeth, with 3-4 short, broad, acute or rather blunt lobes each side, at flowering time pale green, glabrous or with a few scattered hairs above, when mature firm, glabrous, dark green and shining above, paler below, 1-2 inches long and nearly or quite as broad, petioles slender, 4-12 lines long, slightly margined at the apex, sometimes slightly villose and glandular when young; flowers 5-12 in a cluster, on slender, short, glabrous or slightly hairy peduncles, calyx glabrous, its lobes narrow, elongated, minutely glandular, stamens 4-8, occasionally 10, anthers pale yellow or whitish; fruit globose or depressed globose, erect, pale red or orange red when ripe, crowned by the short erect or spreading calyx lobes, nutlets 2-3.

Clayey soil. Albany, North Greenbush and Westport. Flowers late in May or early in June, fruit ripens late in September. Closely related to *C. coccinea rotundifolia*, from which it may be separated by its thinner leaves, mostly fewer stamens, paler fruit and fewer nutlets. Our examples are shrubs more glabrous than the type. The young unfolding leaves are sometimes tinged with brownish red.

Crataegus praecoqua Sarg.*Early thorn*

Rhodora, 3:27, 5:167

Shrub 8-10 feet tall with spreading branches; leaves ovate, oval or rhomboidal, acute or blunt at the apex, broadly cuneate at the base or on young vigorous shoots sometimes rounded, serrate, slightly divided into numerous short, narrow, sharp pointed lobes on each side, at flowering time thin, pale green and clothed above with short appressed whitish hairs, paler below and villose along the midrib and principal veins, when mature thick, dark green, shining, glabrous or scabrous above, paler below, 1.5-2 inches long, nearly or quite as broad, petioles stout, 4-6 lines long, margined on the upper part; flowers on villose, often branching peduncles, calyx tube hairy, its lobes narrow, elongated, glandular serrate, stamens 10, anthers pink; fruit subglobose, erect or drooping, slightly hairy, dark red.

Clayey soil. Crown Point. Flowers the latter part of May, fruit ripens the last of August or early in September. The species was first published under the name *Crataegus praecox*, but this was afterward changed to *C. praecoqua*.

Crataegus egglesoni Sarg.*Eggleston's thorn*

Rhodora, 3:30

Shrub 5-10 feet tall with slender spreading or ascending branches; leaves oval, elliptic or suborbicular, acute or sharp pointed at the apex, broadly rounded or cuneate at the base, serrate, divided into 4-5 short inconspicuous acute lobes on each side, at flowering time thin, yellow green and hairy above with short whitish appressed hairs, paler and glabrous below, when mature thick or subcoriaceous, dark green and scabrous above, 1.5-2 inches long and nearly or quite as broad, petioles slender, 6-12 lines long, slightly margined at the apex, sparingly glandular; flowers 6-8 lines broad, 5-10 in a cluster, on rather long, loosely villose often branched peduncles, calyx tube glabrous or slightly hairy, its lobes entire or minutely glandular serrate, hairy on the inner surface, stamens 5-8, usually 5, anthers red or rose color; fruit subglobose or oval, crimson when ripe, the mostly persistent calyx lobes reflexed, appressed, nutlets 2-3, 3 lines long.

Clayey and shaly soil. Crown Point and Lansingburg. Flowers May 20-30, fruit ripens in September. The shrubs in the station near Lansingburg have recently been cut down. The spines are slender, straight or nearly so and 1.5-2 inches long. This species was originally placed in the section *Anomalae*, but there seems to be no character by which it may be clearly separated from the section in which it is here placed.

***Crataegus brainerdi* Sarg.**

Brainerds thorn

Rhodora, 3:27

Shrub 6-10 feet tall with ascending or suberect branches; leaves at first thin, ovate or broadly ovate, acute or acuminate at the apex, rounded or broadly cuneate at the base, or on young and vigorous shoots often subtruncate or slightly cordate, sharply serrate, divided into 4-5 slight, acute or sharp pointed lobes each side, when young slightly hairy above with short appressed whitish hairs, glabrous below, when mature thicker and firmer, dark green above, paler below, 1.5-2 inches long, 1-1.5 broad, larger on young and vigorous shoots, petioles slender, 4-12 lines long, glabrous, with few or no glands; flowers in clusters of 6-12, 9-10 lines broad, very fragrant, supported on slender, glabrous, simple or branched peduncles, calyx lobes linear lanceolate, entire or slightly glandular, often tinged with red, stamens 20, anthers bright red, filaments elongated, often becoming red or pink, very persistent; fruit erect, subglobose or short oblong, 5-6 lines long, 4-5 broad, bright scarlet, flesh yellow, edible, nutlets 3-4.

Rocky or bushy pastures. Sandlake, Rensselaer co. Flowers May 15-25, fruit ripens the latter part of September. The long erect persistent reddish filaments afford an attractive and easily recognized character. They sometimes remain plump and fresh till the beginning of September. The blossoms have a decided potash odor and are very attractive to honey bees. The styles are generally 3 but occasionally 4. The species is rare with us, but well marked and beautiful both in flower and fruit.

TOMENTOSAE

Fruit small or medium, subglobose, oval or pyriform, orange red or scarlet, nutlets 2-5 with a cavity on each of the ventral faces; flowers usually many in a cluster; leaves thin or coriaceous, usually pubescent beneath.

Crataegus succulenta Link*Succulent thorn*

Silva N. A. 13:139, t.181

Shrub or bushy tree 8-15 feet tall with widely spreading or ascending branches; leaves elliptic or subrhomboidal, acute or sharp pointed at the apex, cuneate at the entire base, serrate, with 4-6 short, acute lobes each side above the middle, at flowering time thin, slightly hairy above, pubescent beneath, when mature coriaceous, dark green and glabrous above, paler below, usually 2-2.5 inches long, 1.5-2 inches broad, on young and vigorous shoots somewhat larger and broadly or concavely cuneate or rounded at the base, petioles stout, 4-8 lines long, margined at the apex, often becoming red or reddish with age; flowers 7-8 lines broad, many in a cluster, supported on long, slender villose branching peduncles, calyx tube hairy or glabrous, its lobes laciniately glandular serrate, elongated, soon reflexed, hairy, stamens 15-20, anthers small, pink; fruit globose, scarlet, drooping, 4-6 lines long, flesh yellow, juicy, edible, nutlets 2-3, 3 lines long.

Clayey soil. Albany and Albia, Rensselaer co. Flowers from May 15-25, fruit ripens in September and usually hangs on the branches till late in October. Sometimes a few persist through the winter.

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SUPPLEMENTARY LIST OF PLANTS OF THE SUSQUEHANNA VALLEY

BY FRANK E. FENNO

Dryopteris goldieana (Hook.) Gray**Aspidium goldieanum** Hook.*Goldie's shield fern*

Hillsides near Nichols. Infrequent. August.

Panicum walteri Pursh**Panicum crus-galli** var. **hispidum** Torr.*Cockspur grass*

Common along the river. August–October.

Panicum minus (Muhl.) Nash*Wood panicum*

Dry woods and thickets near Nichols. Not common. August, September.

Eragrostis major Host*Pungent meadow grass*

Roadsides and along railways. Frequent. August, September.

Panicularia elongata (Torr.) Kuntze**Glyceria elongata** Trin.*Long manna grass*

In a swamp near Smithboro. Infrequent. August, September.

Eleocharis palustris (L.) R. & S.*Creeping spike rush*

Low wet grounds, specially along the river. Common. August, September.

Smilax rotundifolia L.*Green brier. Catbrier*

Thickets near Nichols. Rare. Stem more or less quadrangular and high climbing. Leaves five nerved. May, June.

Lemna trisulca L.*Ivy-leaved duckweed*

Ditches and sloughs. Frequent. July, August.

Corylus americana Walt.*Hazelnut*

Thickets along the river. Common. Apparently not found here on the uplands. March, April.

Corylus rostrata Ait.*Beaked hazelnut*

Fence rows and thickets. Common. April.

Betula populifolia Marsh.*White birch*

Plentiful along the valley road 3 miles south of Owego. May.

Betula lenta L.*Black birch*

Rich woodland. Common. April, May.

Betula lutea Mx.*Yellow birch*

Rich moist woodland. Common. April, May.

Alnus incana (L.) Willd.*Tag alder*

Borders of streams and swamps. Common. February–April.

Alnus rugosa (Du Roi) K. Koch*A. serrulata* Willd.*Smooth alder*

Mutton hill pond. This is its only station. February–April.

Fagus americana Sweet**Fagus ferruginea Ait.***Beech*

Scattered throughout our territory. May.

Castanea dentata (Marsh.) Borkh.**Castanea sativa var. americana Wats.***Chestnut*

A very common tree. July.

Syndesmon thalictroides (L.) Hoffmg.**Anemonella thalictroides Spach***Rue anemone*

Woods and thickets. Common. April–June.

Rubus occidentalis L.*Black raspberry*

Fence rows and neglected fields. Common. May, June.

Rhus copallina L.*Mountain sumac. Dwarf sumac. Upland sumac*

Dry soil 3 miles south of Owego. Rare. June, July.

Parsonsia petiolata (L.) Rusby**Cuphea viscosissima Jacq.***Blue waxweed. Tarweed*

Abundant in a neglected field near Nichols. August–October. Fine flowering specimens were collected as late as Oct. 24. The whole plant is very viscid pubescent.

Mitchella repens L.*Partridge berry. Twin berry*

Woods. Common. June.

Cephalanthus occidentalis L.*Button bush*

Swamps. Common. July, August.

Galium aparine L.*Cleavers*

Damp shaded ground. Common. Summer.

Galium pilosum Ait.*Hairy bedstraw*

Dry bushy places. Frequent. Summer.

Galium lanceolatum Torr.*Torrey's wild liquorice*

Dry woods. Common. Summer.

Galium circaezans Mx.*Wild liquorice*

Dry woods. Common. May-July.

Galium boreale L.*Northern bedstraw*

Rocky soil, specially along streams. Common. June.

Galium asprellum Mx.*Rough bedstraw*

Swamps and low grounds. Common. Summer.

Galium triflorum Mx.*Sweet-scented bedstraw*

Damp woodland. Common. Summer.

EXPLANATION OF PLATES**PLATE O****Inocybe castanea Pk.****CHESTNUT INOCYBE**

1, 2 Two immature plants

3, 4 Two mature plants

5 Vertical section of the upper part of an immature plant

6 Vertical section of the upper part of a mature plant

7 Transverse section of a stem

8 A cystidium, x 400

9 Four spores, x 400

Inocybe squamosodisca Pk.

SCALY DISKED INOCYBE

10 Immature plant

11 Mature plant showing scaly disk

12 Vertical section of the upper part of a mature plant

13 Four spores, x 400

Inocybe excoriata Pk.

EXCORIATED INOCYBE

14 Immature plant

15, 16 Mature plants showing the excoriated surface of the caps

17 Vertical section of the upper part of an immature plant

18 Vertical section of the upper part of a mature plant

19 Four spores, x 400

Inocybe fallax Pk.

FALLACIOUS INOCYBE

20 Immature plant

21 Mature plant

22 Vertical section of the upper part of an immature plant

23 Transverse section of a stem

24 A cystidium, x 400

25 Four spores, x 400

Tricholoma subluteum Pk.

TWO COLORED TRICHOLOMA

26 Immature plant

27 Mature plant

28 Vertical section of the upper part of a plant

29 Four spores, x 400

Stereum burtianum Pk.

BURT'S STEREUM

30 Small plant

31 Plant with lacerated margin of the pileus

32 Plant with incomplete pileus

33 Three plants with confluent pilei

34 Four spores, x 400

PLATE 84

Collybia familia Pk.

FAMILY COLLYBIA

- 1 Cluster of small plants
- 2 Cluster of large plants with the center of the cap colored
- 3 Single large plant
- 4 Single large plant with the center of the cap colored
- 5 Vertical section of the upper part of a large plant
- 6 Transverse section of a stem
- 7 Four spores, x 400

Collybia acervata Fr.

TUFTED COLLYBIA

- 8 Cluster of eight plants, four with caps moist and more highly colored
- 9 Plant with pale tan colored cap
- 10 Plant with whitish cap
- 11 Vertical section of the upper part of a large plant
- 12 Transverse section of a stem
- 13 Four spores, x 400

Bovista pila B. & C.

ROUND BOVISTA

- 14 Immature plant
- 15 Mature plant ruptured at the apex
- 16 Vertical section of a young plant in edible condition
- 17 Part of a branching filament of the capillitium, x 400
- 18 Four spores, x 400

PLATE 85

Russula mariae Pk.

MARY'S RUSSULA

- 1, 2 Immature plants
- 3 Mature plant
- 4 Immature plant of darker color
- 5 Mature plant of darker color
- 6 Vertical section of the upper part of an immature plant
- 7 Vertical section of the upper part of a mature plant
- 8 Four spores, x 400

Russula furcata (Pers.) Fr.

FORKED RUSSULA

- 9 Immature plant
- 10 Mature plant with the cap partly expanded
- 11 Mature plant with the cap fully expanded
- 12 Vertical section of the upper part of an immature plant
- 13 Vertical section of the upper part of a mature plant
- 14 Four spores, $\times 400$

PLATE 86

Psilocybe foenisecii (Pers.) Fr.

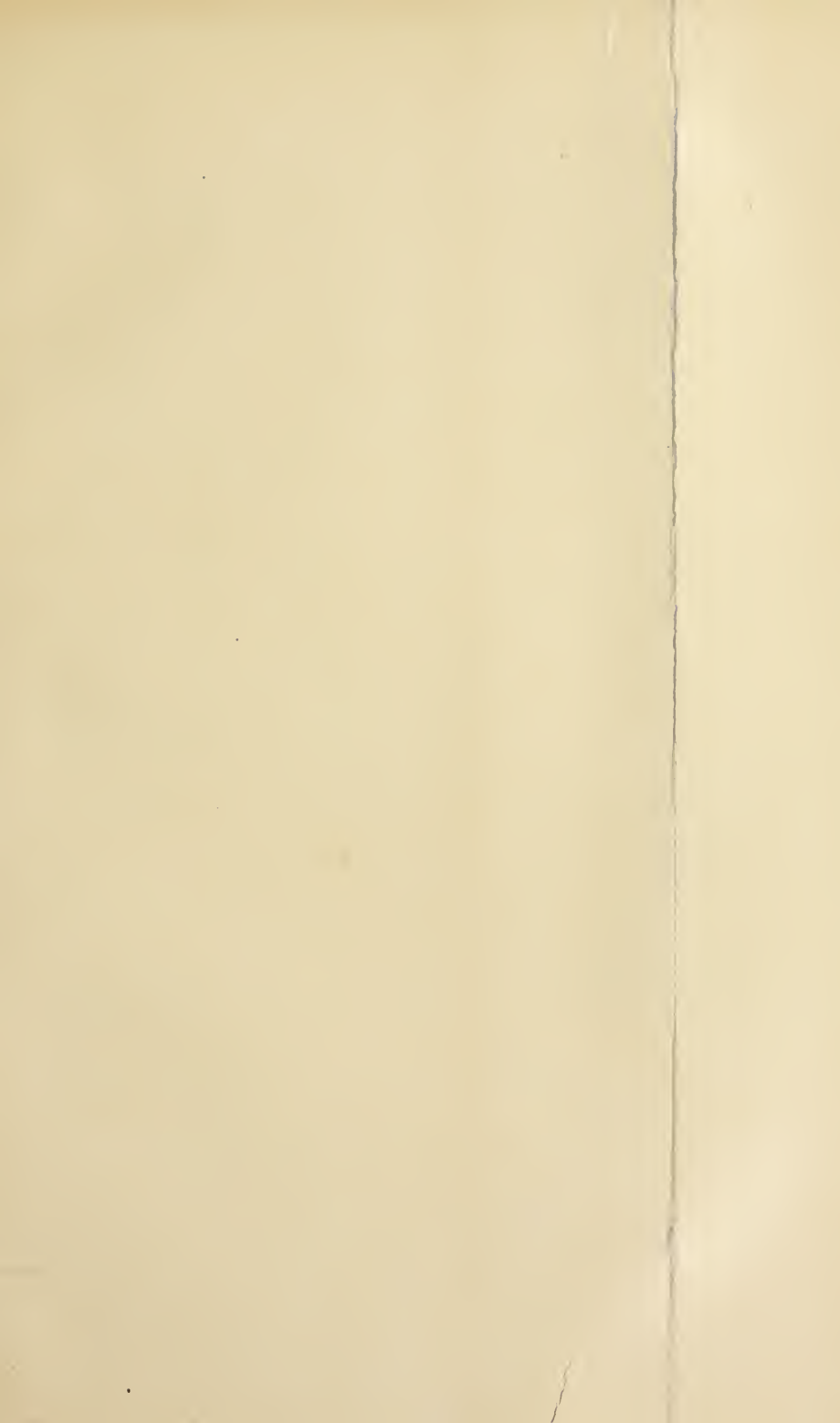
HAYMAKER'S PSILOCYBE

- 1-3 Immature plants with moist striatulate caps
- 4 Plant after the moisture has partly escaped from the cap
- 5-7 Mature plants with caps destitute of moisture
- 8, 9 Vertical sections of the upper part of two plants
- 10 Transverse section of a stem
- 11 Four spores, $\times 400$

Pholiota vermiflua Pk.

WORMY PHOLIOTA

- 12 Young plant with gills hidden by the veil
- 13, 14 Immature plants showing the whitish gills
- 15 Mature plant with the cap fully expanded
- 16 Mature plant with the cap rimosely areolate
- 17 Vertical section of the upper part of an immature plant
- 18 Vertical section of the upper part of a mature plant
- 19 Transverse section of a stem
- 20 Four spores, $\times 400$



FUNGI



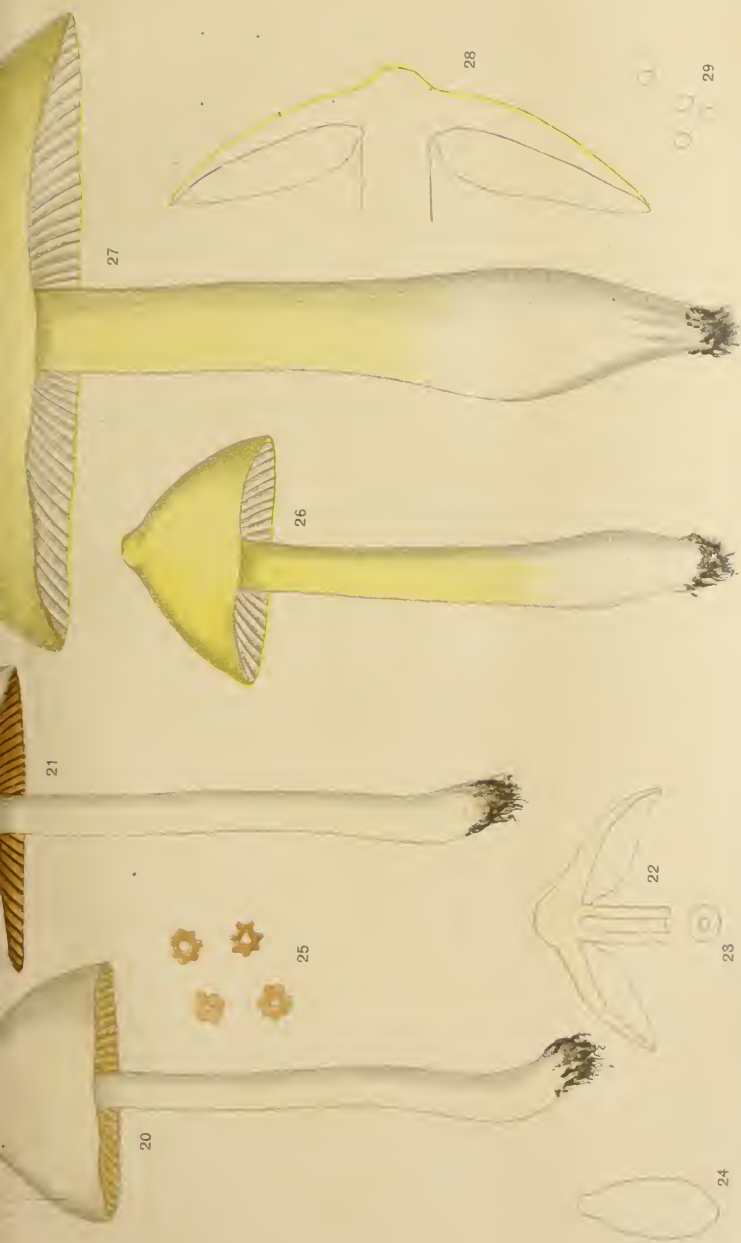


FIG. 1-9 INOCYBE CASTANEA PK.

CHESTNUT INOCYBE

FIG. 14-19 INOCYBE EXCORIATA PK.

EXCORIATED INOCYBE

FIG. 10-13 INOCYBE SQUAMOSODISCA PK.

SCALY DISKED INOCYBE

FIG. 20-25 INOCYBE FALLAX PK.

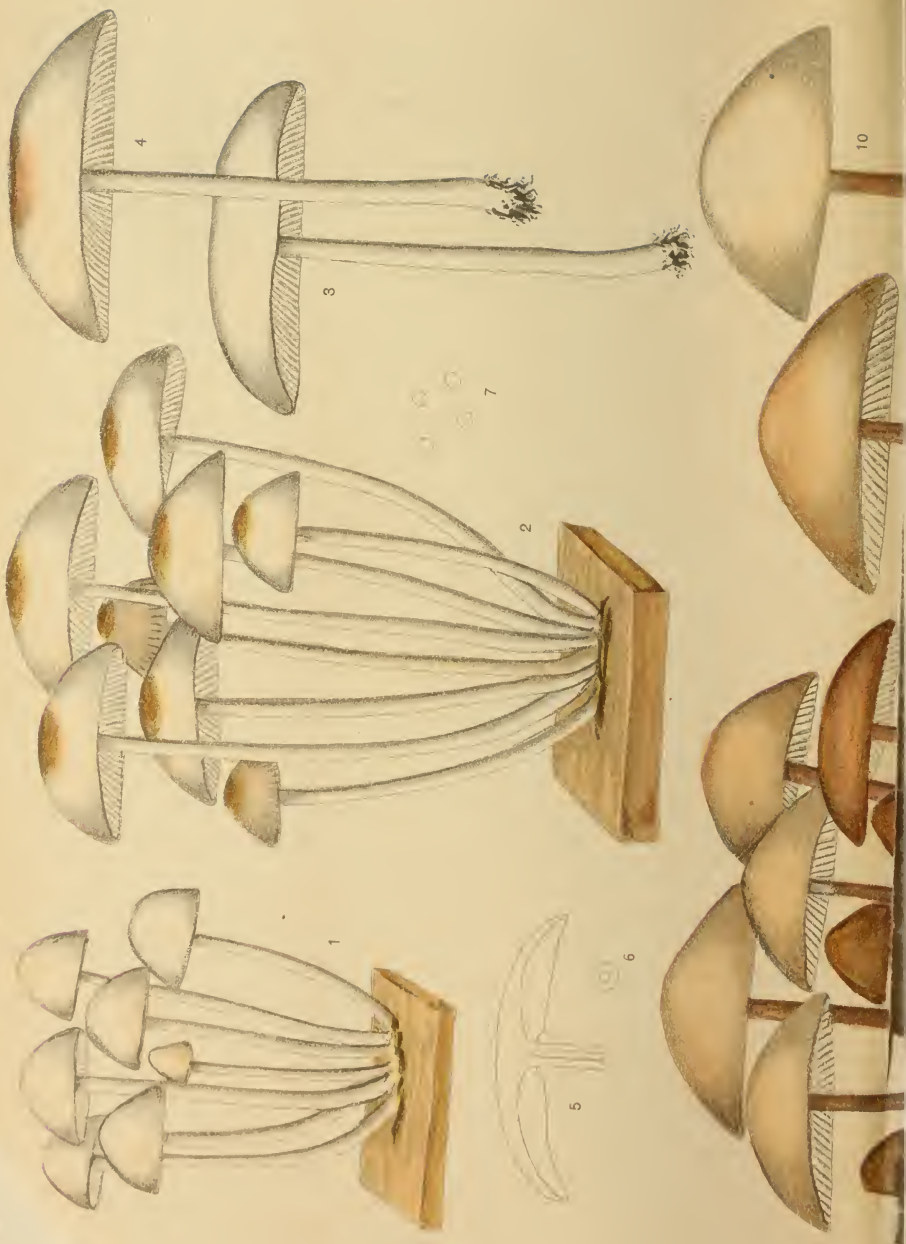
FALLACIOUS INOCYBE

FIG. 26-29 TRICHOLOMA SUBLUTEUM PK.

TWO COLORED TRICHOLOMA

FIG. 30-34 STEREOUM BURTIANUM PK.

BURT'S STEREOUM

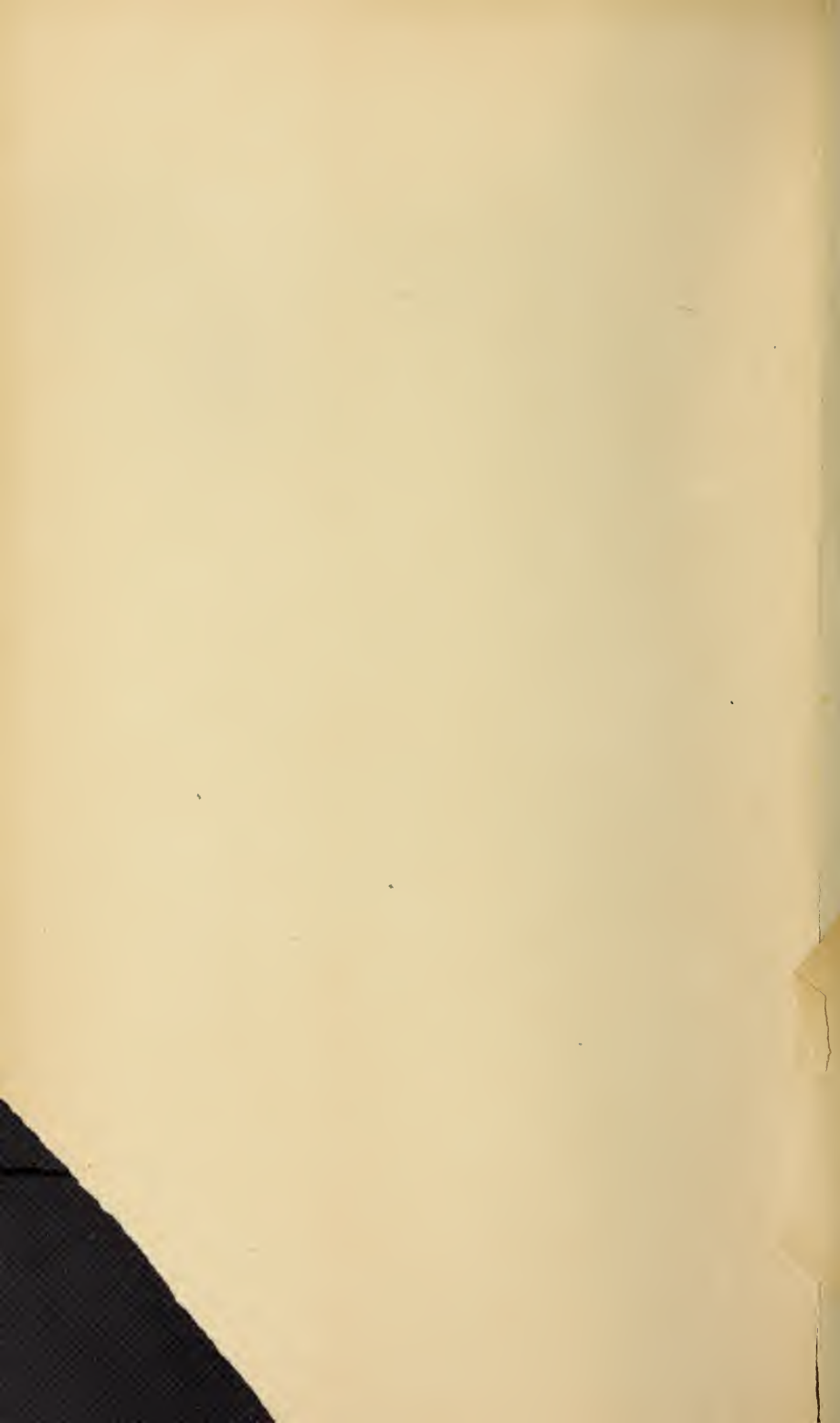


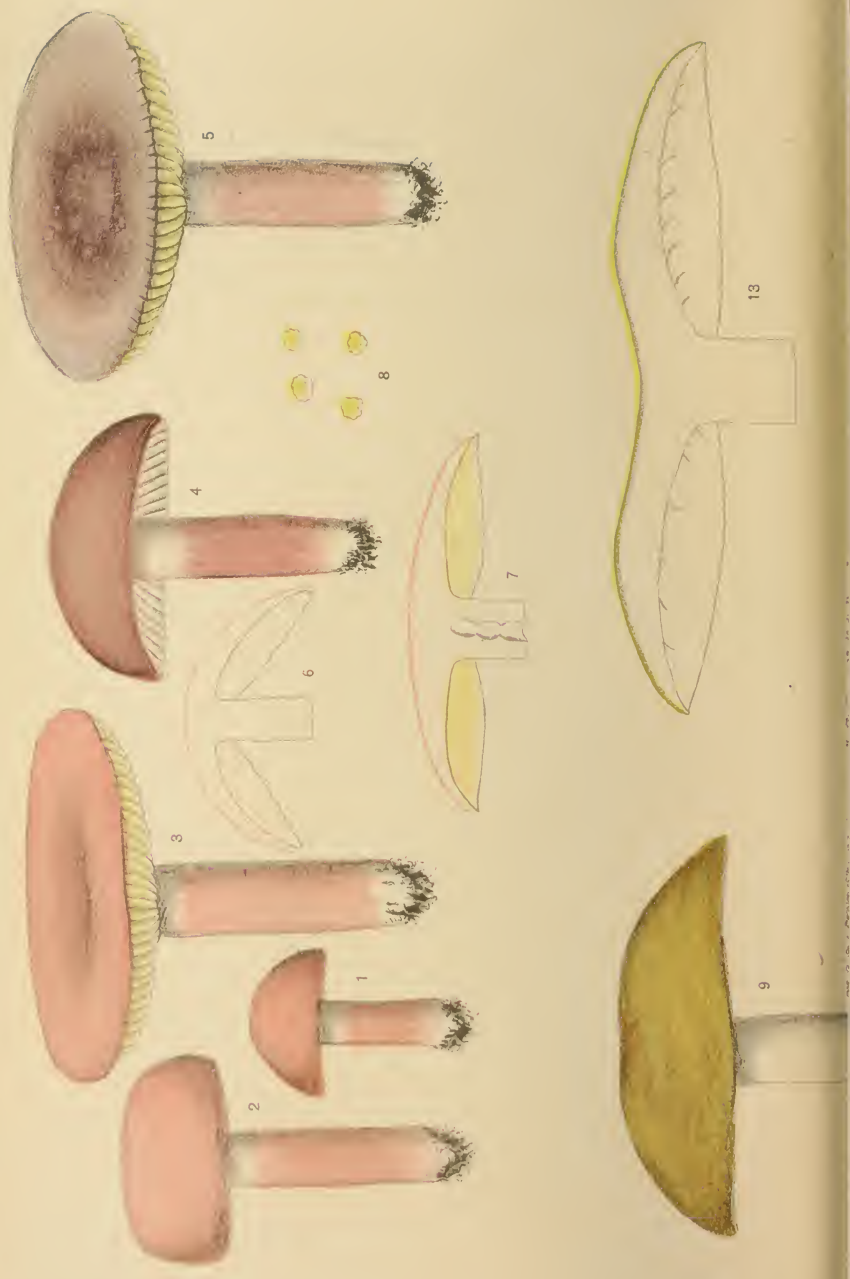


COLLYBIA FAMILIA PK.
TILY COLLYBIA

FIG. 8-13 COLLYBIA ACERVATA FR.
TUFTED COLLYBIA

FIG. 14-18 BOVISTA PILA B & C.
ROUND BOVISTA





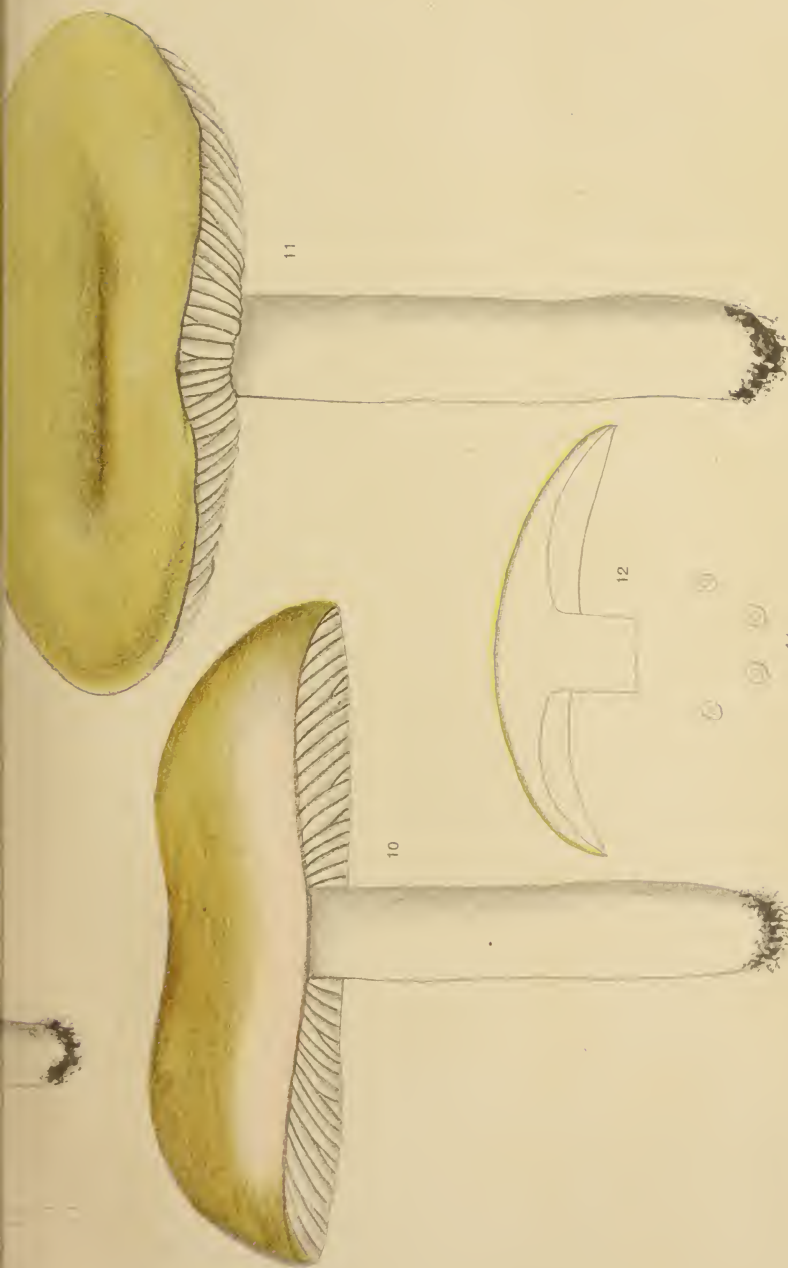
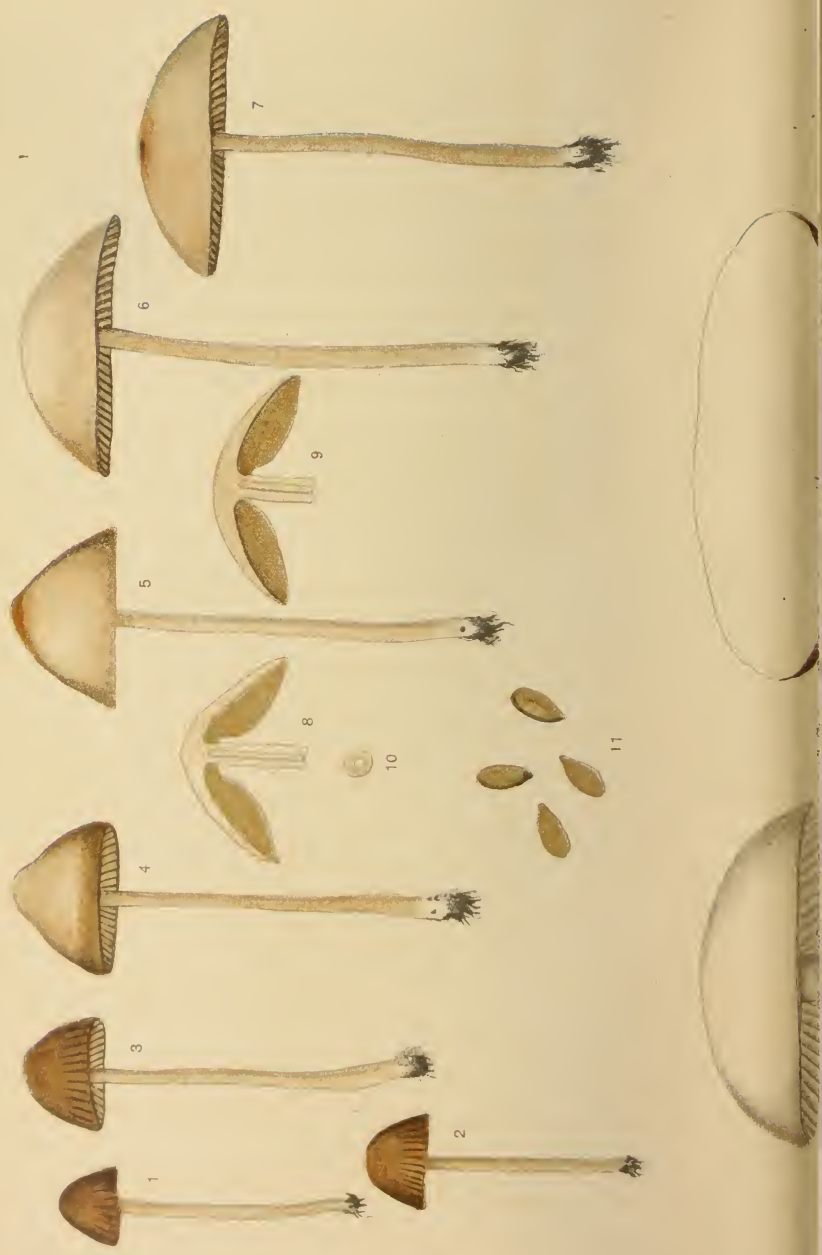


FIG. 1-8 RUSSULA MARIAE PK.
MARY'S RUSSULA

FIG. 9-14 RUSSULA FURCATA (PERS.) FR.
FORKED RUSSULA



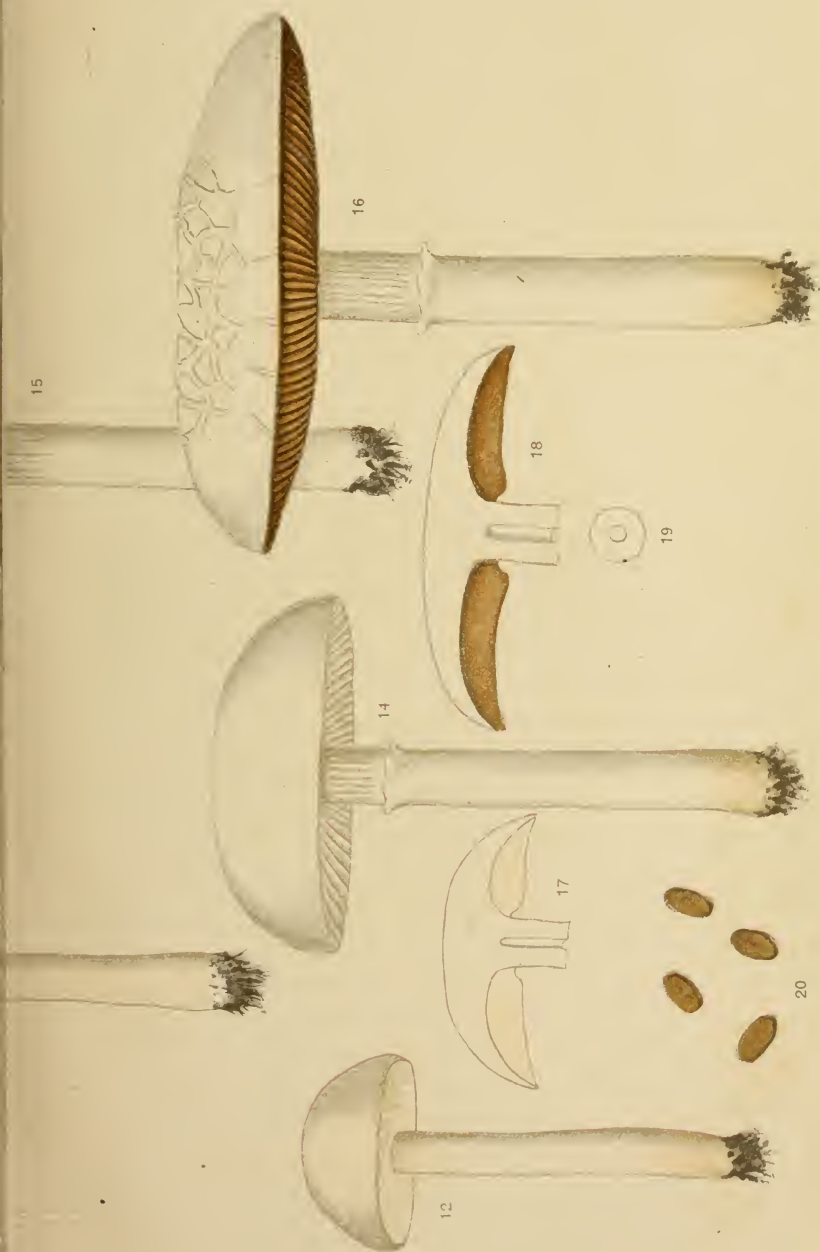


FIG. 1-11 *PSILOCYBE FOENISECII* (PERS.) FR.
HAY MAKER'S *PSILOCYBE*

FIG. 12-20 *PHOLIOTA VERMIFLUA* PK.
WORMY *PHOLIOTA*



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New York State Museum

EPHRAIM PORTER FELT State Entomologist

Bulletin 76

ENTOMOLOGY 21

19th Report of the State Entomologist

ON

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK

1903

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Bulletin 76

ENTOMOLOGY 21

19th REPORT OF THE STATE ENTOMOLOGIST 1903

To the Regents of the University of the State of New York

I have the honor of presenting herewith my report on the injurious and other insects in the State of New York for the year ending Oct. 15, 1903.

General entomologic features. The season of 1903 will long be known on account of the abnormal abundance of plant lice of various species, which have not only been exceedingly destructive to fruit trees in particular but the prolongation of their depredations far beyond the usual date was specially injurious to young or recently set trees. The latter part of the summer the San José scale, *Aspidiotus perniciosus* Comst., bred so excessively that many trees were literally covered with half grown scale insects toward the end of the season. The depredations of the elm leaf beetle, *Galerucella luteola* Müll., have continued in the Hudson river valley though the spraying operations of recent years have reduced their numbers very largely in Albany and Troy. An interesting feature of this insect's history was its presence in excessive numbers at Saratoga Springs, where it would undoubtedly have caused severe injury had it not been for the prompt spraying instituted by the village authorities. The white marked tussock moth, *Notolophus leucostigma* Abb. & Sm., has caused less damage than usual in recent years

though it was generally present at Buffalo on a great many horse-chestnut trees, partially defoliating thousands. The fall web-worm, *Hyphantria textor* Harr., has, as a rule, been less injurious than in preceding years, except in a few localities.

Office work. The general office work has been conducted as in preceding years and has been marked by many more demands for information, indicating an increased interest. The determinations of scale insects for the commissioner of agriculture, in connection with the nursery inspection work of his department, has made somewhat extensive demands on the time of Assistant C. M. Walker, who has also had charge of most of the breeding cage work. Many photographs of living insects or specimens of their work have been taken and a number of lantern slides added to the collection, greatly increasing its effectiveness in illustrating popular lectures. It is gratifying to record that there have been no changes in the office staff during the past year, and consequently the work has proceeded without interruption from this cause. Correspondence indicates a continued and healthy interest in our work, as is evidenced by the following figures: 2035 letters, 784 postals, 490 circular letters and 1109 packages were sent through the mail during the past year. The reduction from last year in the number of postals and packages is due to the fact that but three publications were issued during the present year against four in 1903, and the last issued was not available for distribution till very late, consequently a portion of the copies will be sent out next year. Mailing expenses have also been reduced by sending two or more publications by express, wherever that was economical, a total of 114 packages being shipped.

Special investigations. The lines of work begun in earlier years have been continued and considerable progress made. The grape-vine root worm, *Fidia viticida* Walsh, has been the subject of more extended investigations than last year, a large amount of exceedingly valuable data has been secured and we have demonstrated that collecting the beetles was a practical, the most reliable and probably the most economical method of controlling this pest. The details of this work will appear in a revised and extended bulletin on this insect. The experiments with insecti-

cides for controlling the San José scale have been carried on in the same orchard as in the past three years, and our earlier results with crude petroleum have been confirmed. Extended experiments with lime-sulfur washes have also been conducted at Warwick with very gratifying results. An extensive series of experiments with summer washes was made, Mr Walker having direct charge of the work and being responsible for most of the observations. A second instalment of the beneficial Chinese ladybeetle, *Chilocorus similis* Rossi, which may prove of value in suppressing this pernicious scale insect, was obtained from the United States Department of Agriculture last August and established in an infested orchard at Kinderhook. It is hoped that they will survive in this latitude and prove of great value in controlling this dangerous pest. The extended forest fires in the Adirondacks early in the season offered an excellent opportunity for investigating the connection between them and insect attack. The results of this work are given on a subsequent page. Our general studies of forest and shade tree insects have been continued and a number of valuable observations made.

The present year has been marked by the appearance of a second report by Dr Needham on aquatic insects, which consists of a series of valuable original articles by himself, supplemented by important papers from Messrs MacGillivray, Johannsen and Davis. Another report by Dr Needham, is now in preparation and will be devoted largely to a consideration of the May flies and midges (*Chironomidae*) of the State.

Investigations on our native mosquitos have been continued, resulting in material additions to our knowledge. Collections of these little insects have been made in different sections of the State, and it was possible for Assistant D. B. Young to spend two weeks at Long Island, working in cooperation with the North Shore Improvement Association, which has become well and favorably known to all interested in this line of effort on account of its very efficient operations in subduing these pests in the vicinity of New York city.

Publications. The principal publications of the entomologist, to the number of 70 are listed under the usual head. The more

important of those issued during the past year are the following: *Grapevine Root Worm* (Museum bulletin 59), *18th Report of the State Entomologist 1902* (Museum bulletin 64) and *Aquatic Insects in New York State* (Museum bulletin 68). In addition, the entomologist has contributed an important paper on insects injurious to pine and oaks, for the seventh report of the Forest, Fish and Game Commission, and one on insecticides for the report of the Colorado State Board of Horticulture for 1902.

Other important publications, which are either in the printer's hands or practically completed, are as follows: *Grapevine Root Worm*, a revised and extended edition of Museum bulletin 59, mentioned above. A monograph of the genus *Saperda*, which includes some of our most destructive borers, has been prepared by the entomologist in association with Mr L. H. Joutel of New York city, and will form a small bulletin of about 80 pages illustrated by 7 colored plates. Dr Needham's third report, mentioned in the preceding paragraph, is practically completed and will be an extended work about the same size as Museum bulletin 68. There is also a memoir on insects injurious to forest and shade trees, an extensive publication illustrated with many halftones and 16 colored plates, treating specially of those forms which are destructive to shade trees.

Collections of insects. Very large additions have been made to the state collections during the past season. They are specially desirable because a considerable proportion have come from other sections of the State. Mr Young spent several weeks in the Adirondacks in special work on forest insects, and he has collected at intervals throughout the season in cooperation with the Vassar Brothers Institute, at Poughkeepsie, and also at Long Island while engaged on mosquito investigations. The results have been large and exceedingly valuable additions to the state collections. Much progress has been made in arranging insects previously collected. The Lepidoptera, which are in the care of Mr Walker, have all been referred to the principal groups and many determined specifically. He has also arranged the Coccidae, now represented by 98 species and a host of specimens, while Mr Young has been able to do considerable systematic work on the Tenthre-

dinidae, Ichneumonidae, Syrphidae, Tachinidae and Capsidae, besides making material progress in arranging the Coleoptera which, it is gratifying to state, are already in a fairly satisfactory condition. The exhibit collection has received valuable additions from time to time, and in all of our collecting an effort has been made to secure material desirable for this purpose. The museum was kindly remembered during the present year and bequeathed a small collection of insects by Miss Ellen L. Baker of Middle Granville N. Y.

The past season a system of exchange was inaugurated with most excellent results. The museum possesses large series of certain species. Lists were prepared and sent to entomologists in different sections of this and other countries with a request for exchanges, and as a result some exceedingly valuable additions have been made to the collection with practically no cost to the museum. The details of these exchanges together with a list of species available for this purpose will be found under a separate head.

Nursery inspection work. Owing to the Virginia authorities refusing in the fall of 1902 to accept nursery inspection certificates issued by the State Department of Agriculture, even though officially indorsed by us, other means had to be devised to aid those who wished to ship nursery stock into Virginia. The state entomologist of Virginia was willing to accept a certificate based on inspection by an assistant working under our direction, and as an accommodation to our nurserymen, it was arranged to send an assistant to make supplementary inspections of only that stock which was destined for Virginia, the parties benefited to pay his traveling expenses. Mr C. M. Walker was detailed for this work, which occupied nearly two weeks. It is very gratifying to state that the regular inspectors, in whom we have utmost confidence, kindly aided Mr Walker in his work. Mr H. C. Peck and Mr J. J. Barden, in whose territory most of the inspecting was done, were specially helpful. The following is a list of firms to whom these nursery certificates were issued between Oct. 21 and Nov. 1, respectively: Mt Hope Nurseries, Western New York Nursery Co., Thomas Bowman & Son, A. L. Wood, Allen Nursery Co., H. S. Taylor & Co., Charlton Nursery Co., all of Rochester; Sheeren

Wholesale Nurseries, George A. Sweet Nursery Co., Rogers Nursery, all of Dansville; Brown Bros. Co., Chase Bros. Co., First National Nurseries, Perry Nursery Co., J. B. Nellis & Co., all of Brighton; Lewis Roesch, T. S. Hubbard Co., G. S. Josselyn Co., all of Fredonia; Knight & Bostwick, Emmons & Co., and C. W. Stuart & Co., all of Newark.

Voluntary observers. The work of the voluntary observers begun in 1899 has been continued, but owing to an unusually dry spell in the early part of the season followed by excessive rains, there has been comparatively little to report except injuries by plant lice, a group of insects on which the voluntary observers are not well qualified to report. As a consequence, there are not so many records as have been made in earlier seasons, though the sum total of their observations amounts to a material addition to our knowledge concerning some very important injurious insects. Summaries of these reports are published under the usual head.

Acknowledgments. The untimely death of our highly esteemed and gifted associate, the late Prof. V. H. Lowe of the State Agricultural Experiment Station at Geneva, is a source of deep regret and a severe loss to the science he loved so well. The entomologist has been favored by the cooperation of a number of professional workers. To Dr L. O. Howard, chief of the division of entomology, United States Department of Agriculture, and his staff, special acknowledgments are due for the determination of a number of insects and for information regarding different species. Mr E. P. VanDuzee, of Buffalo, a well known authority on Hemiptera, has kindly identified all our Pentatomidae and a number of related forms, and we are indebted to Prof. Mel. T. Cook, of De Pauw University, Greencastle Ind., for the determination of many insect galls. The appreciation of our work by the many friends of the office is a source of pleasure, and the support given by those in authority is very gratifying.

Respectfully submitted

EPHRAIM PORTER FELT

State Entomologist

Office of the State Entomologist

Albany, Oct. 15, 1903

BENEFICIAL INSECTS

SYNOPSIS OF CERTAIN GENERA OF THE OPHIONINI

The following account of species belonging to various genera of this group is the result of a study, extending over some years, originally begun at Cornell University under the auspices of Prof. J. H. Comstock, to whom the writer is under deep obligations for assistance. The original assignment covered the species placed in this genus by Cresson, and owing to many other matters demanding attention, we have reluctantly decided to publish our results without attempting to extend our studies so as to include all the members of this group, particularly because of lack of time, and specially since a number of genera are represented only by foreign species. We also take this opportunity to express our obligations to Dr W. H. Ashmead, curator of the Hymenoptera, United States National Museum, who in recent years has kindly loaned us specimens and afforded material aid in our systematic study.

This group includes some of our larger and more common parasites, and to the species comprising it much credit is due for material aid in controlling a number of our insect pests. For example the long-tailed Ophion, *Eremotylus macrurus* Linn. is a common parasite of large cecropia larvae and allied species. These large caterpillars are rarely abundant enough to attract attention by their ravages, and one reason for this is undoubtedly the activity of their parasites, foremost of which stands the long-tailed Ophion.

Value as parasites

The other species of this group have been reared from a large number of hosts, and there is no reason for regarding several of them as of less value than *Eremotylus macrurus* Linn. The following statistics will give some idea of their abundance and, as the life of the host with its attendant possibilities is destroyed as each develops, they also give some idea of the economic value of the species. Six trap lanterns were in operation during the entire season of 1889 at Cornell University for the purpose of ascertaining the value of lights for destroying insects, and nearly

600 examples of ophionids were taken. Two species were well represented in this lot. There were none of the long-tailed Ophions, hence the figures give no idea of the relative abundance of this parasite or of the other species not represented. The one by far the most abundant was *Ophion bilineatum* Say, the two-lined Ophion, which was represented by 450 examples. The species next in abundance was *Ophion tityri* Pack., which was represented by 118 examples, while *Eniscopilus purgatus* Say was represented by but 23 individuals. It will be noticed that the two species taken most abundantly are not well represented in most collections and but little is known of their habits. This record does not in the least reflect on the value of these two as parasites. It is possible that both are equally efficient in their own fields and it is most probable, seeing that they are crepuscular or nocturnal in habit, that they breed largely in larvae which rarely fall into the hands of the collectors. The two-lined Ophion has been reared mostly from arctians or noctuids. Though records of this character are still far too scarce to permit the formation of a positive opinion, it is likely that this species does material service in keeping larvae belonging to these two families in check. The observations are even more meager regarding *Ophion tityri*. Here is certainly a field for investigation.

General habits

The different members of this group may usually be seen flying slowly about shrubbery and in the grass during bright days from early May till into October. In cloudy and wet weather they seek some sheltered place—at least this is true of the diurnal species. The long-tailed and the purged Ophions are the two taken most commonly in the day, and they are the best represented in most collections examined. The trap lantern record would appear to indicate a great preponderance of the two-lined Ophion. This must be ascribed to the crepuscular or nocturnal habits of the latter form. The females are the more active and are more abundant in collections. This might be expected, as on her devolves the labor of searching out a suitable nidus for

her eggs. The large proportion of females is well shown in the trap lantern record, where but 87 males were taken to 485 females. The great activity of the females and the large number of them attracted to lights must diminish materially the value of the trap lantern as a means of destroying insect pests.

Oviposition and larval habits

The females possess a sharp ovipositor which is capable of inflicting a slight wound. Its sharpness appears to be mainly for defensive purposes, as the eggs are deposited usually on the skin of the host, to which they firmly adhere by means of a cement or glue extruded at the moment of oviposition. The deposit of the egg by *Eremotylus macrurus* has been graphically described by Trouvelet as follows¹: "When an Ichneumon detects the presence of a worm, she flies around it for a few seconds, and then rests upon the leaf near her victim; moving her antennae very rapidly above the body of the worm, but not touching it, and bending her abdomen under the breast, she seizes her ovipositor with the front legs, and waits for a favorable moment, when she quickly deposits a little oval white egg upon the skin of the larva. She is quiet for some time and then deposits another upon the larva, which only helplessly jerks its body every time an egg is laid." Eight to ten eggs are laid in this manner. A few days later they hatch and the larvae make their way under the skin of their victim, feeding on the fatty portions of the host at first, but later most of the tissues are devoured. The miserable victim of these parasites drags out a weary existence and usually perishes in the pupal state, rarely before. As a single larva will provide sustenance for the development of but one or two parasites, the weaker ones perish.

There is on the front tibia of *Ophion* an articulated, apical spine, a structure common to many Hymenoptera, which is possibly connected with the method of oviposition narrated above. This articulated spine is curved toward the tarsus near the apex, and might consequently be used for holding the ovipositor, be-

¹1868 Am. Nat. 1:89-91.

cause when apposed to the tarsus the bend is such as to allow the ovipositor to pass easily through a space between the two. It is worthy of note in this connection, as showing the method of depositing eggs by an insect belonging to the same family, that *Thalessa* has been seen ovipositing in a similar manner by reliable observers.¹

Pupation and final transformations

The larva of *Eremotylus macrurus* usually pupates within the cocoon of its victim. As this species preys largely on the saturnians, the larvae of which spin stout cocoons, the grub of the parasite on emerging from the remains of its victim finds itself in a well protected cocoon, and consequently has no need of looking for a more secure place in which to undergo its final transformations. The same habit is probably common to other species infesting hosts spinning a stout cocoon, as, for example, *Erem. arctiae* when preying on these moths. The cocoons of *Eniscopilus purgatus* are found in the soil or under shelter near where its host has transformed. From the lack of evidence to the contrary, it may be presumed that such is the general habit of all the species infesting larvae that do not spin stout cocoons before pupation.

Very few notes exist on the duration of the pupa state in this genus. Riley states that the imagos of *Erem. macrurus* commonly emerge in the spring, and rarely come forth in the autumn. This would apparently indicate that the normal habit of this insect is to pass the winter in the pupal stage. An example of *Enis. purgatus* has been known to pupate July 24, the imago emerging Sep. 13.

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These are references to the genus only, as defined by Cresson in 1887.

Synopsis of genera treated

- a* Cubitodiscoidal nervure irregularly thickened, never appendiculate
b Yellowish chitinous spots in cubitodiscoidal cell....Eniscopilus *Curtis*
bb No such spots in cubitodiscoidal cell.....Eremotylus *Forster*
aa Cubitodiscoidal nervure never irregularly thickened, usually appendiculate
b Face normal.....Ophion *Gravenhorst*
bb Face elongated.....Genophion *Felt*

Synopsis of species of *Eremotylus*

- a* Cubitodiscoidal vein usually strongly sinuate; hooks of hind wings 13-15; male clasps rather long, subrectangular, obtusely rounded at the apex.....*macrurus* Lim.
aa Cubitodiscoidal vein nearly arcuate; first and second recurrent nervures nearly equal; hooks of hind wing 7-9; male clasps subrectangular, acutely rounded.....*arctiae* Ashm.
glabratus Say¹

Eremotylus macrurus Linn.

Long-tailed Ophion

This, the largest American species of the genus, is closely allied to *Erem. arctica* Ashm., which has been confused with it in collections. The two species are easily separated from the others of the genus by their considerably larger size; the smallest being perceptibly larger than the largest of the other species, excepting

¹See account of this species, p.106.

Ophiomacrus fuliginipennis Felt, which belongs in a different group. *Erem. macrurus* may be separated from *Erem. arctiae* by its larger size, by the fulvous tinge of the wings and veins, by the second discoidal nervure being nearly twice the length of the first, and by there being from 13 to 15 hooks on the hind wings. Other differences are detailed in the description of *Erem. arctiae*.

Habits and life history. This species is an active, diurnal insect, being rarely if ever attracted to lights. It is the one most commonly bred from the large saturnians, and is frequently referred to as a parasite of one or more of them. Its egg-laying habits and life history, so far as known, have been described in a preceding paragraph. It has also been recorded as bred from some of the arctians, but it is probable that some of these records really pertain to *Erem. arctiae*. Dr C. M. Weed has recorded an instance in which 30 out of 50 pupae of *Samia columbia* Smith were parasitized by this insect. The unusual abundance of *Callosamia promethea* Dr. is recorded in *Insect Life*, 2:383, and also the interesting fact that fully two thirds of the pupae harbored this parasite. The observations of Dr Riley show that this insect usually emerges in the spring, though occasionally individuals come forth in the autumn.

This parasite has been reared from the following insects: *Isia isabella* Abb. & Sm., *Philosamia cynthia* Drury, *Callosamia promethea* Drury, *Samia columbia* Smith, *Samia cecropia* Linn., *Telia polyphemus* Cram., *Automeris io* Fabr. and *Apatelodes torrefacta* Abb. & Sm.

Description. Fulvo-ferruginous, stigma almost obsolete; marginal nervure sinuate, thickened toward the stigma; size large; body 31 to 38 mm long; wing spread 43 to 56 mm. Head small; antennae nearly as long as the body; ocelli prominent, black; head yellowish posteriorly; eyes black, rather small; mandibles bidentate, tipped with black. Mesothorax convex; scutellum and postscutellum prominent; anterior portion of metathorax depressed; posterior portion rugose, limited anteriorly by a transverse carina; lateral carinae present. Wings hyaline; marginal nervure thickened, sinuate near the small stigma; cubitodiscoidal nervure never appendiculate, usually strongly sinuate; third dis-

oidal cell considerably wider at apex than base; hooks on hind wings 13 to 15. Legs long, honey yellow. Abdomen long, strongly compressed, usually darker at tip. Male claspers rather long, subrectangular, obtusely rounded at apex.

Described from 10 examples.

Cocoon. The larva leaves the shriveled remains of its victim when full grown and pupates within the cocoon spun before the demise of its host. The cocoon is tough, oval, about 32 mm long and 17 mm broad, and occupies the larger portion of that spun by its prey. It is composed of silk agglutinated by a dark secretion. Exteriorly it is a dark brown color, with a faint yellowish or golden band around the center. The interior is thinly lined with a transparent substance and possesses a brilliant metallic luster.

Distribution. The recorded distribution of this insect is from New England to California and from Canada to Texas, indicating that the species ranges over practically the whole of the United States and north into Canada. It has been reported from the following localities: Canada, New England, New York, New Jersey, Pennsylvania, District of Columbia, Virginia, Louisiana, Illinois, Missouri, Nebraska, Colorado, Texas, Nevada and California.

Specimens have also been examined from the following localities: Ottawa, Canada [Harrington]; New York city [Joutel]; Dutchess county, N. Y. and Rock Creek park, Washington D. C. [U. S. Nat. Mus.] and from Malden and Amherst Mass. [Fernald].

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Eremotylus arctiae Ashm.

This species is by no means rare, though not recognized as a distinct form till 1890 owing to its having been confused with *Erem. macrurus*, which it closely resembles. A critical examination of the material in the state collection, Dr Lintner's private collection, and that from Cornell University, lent by Professor Comstock, has resulted in the finding of several examples of this species. Two specimens were taken in the trap lanterns at Cornell; one Aug. 3 and the other Aug. 22, 1889. Owing to the kindness of Messrs Howard and Ashmead, we have been permitted to examine a type of this species.

Hosts. This species is parasitic mostly on some of the arctians, though it has also been reared from saturnians. The following hosts are known: *Ecpantheria deflorata* Fabr., *Diacrisia virginica* Fabr., *Automeris io* Fabr. and *Callosamia promethea* Drury.

Description. The following is Mr Ashmead's description:

In *Erem. macrurus*, the wings have a decided fulvous tinge and the veins are fulvous; the second recurrent nervure is about twice as long as the first recurrent nervure, the third discoidal cell, therefore, is much wider at apex than at base; in *Erem. arctiae*, the wings are entirely without the fulvous tinge and the basal nervure, tips of median and discal nervures vary from brown to black, or piceo-black; the second recurrent nervure is only slightly longer than the first recurrent nervure, the cubital nervure being arcuate and the third discoidal cell, therefore, is about as wide at apex as at base; in *Erem. macrurus*, the transverse metathoracic carina is always more or less distinctly sinuated at the middle, in *Erem. arctiae* it is straight. In *Erem. arctiae* the hooks on the hind wings vary from seven to nine; in *Erem. macrurus* they are from 13 to 15; in the former the claws are pectinate; in the latter simple.

Male 26 mm long, wing expanse 35 mm; female 20 to 28 mm long, wing expanse 36 to 40 mm.

Figure 6 on plate 2 represents the wing characters of *Erem. macrurus*. In *Erem. arctiae* the cubitodiscoidal nervure is arcuate; in the type examined it was a nearly perfect arc, but in other specimens there was a slight tendency to the

sinuous course usually so marked in *Erem. macrurus*. The form of the third discoidal cell in the type was a little more regular than in our specimens and the first and second recurrent nervures were more nearly of an equal length. The wings of *Erem. arctiae* appear to be proportionately wider than in *Erem. macrurus*. In a study of examples of *Erem. macrurus*, I find the claws pectinate as well as in *Erem. arctiae*. The claspers of the male in the former species are rather long, subrectangular and obtusely rounded at tip, while in the latter they are subtriangular and acutely rounded at tip.

Distribution. This species is probably as widely distributed over this county as is *Erem. macrurus*. It is known to occur in New York, New Jersey, District of Columbia, Alabama, Mississippi and California, and specimens are before the writer from the following localities: Ottawa, Canada [Harrington]; Malden and Amherst Mass. [Fernald]; Michigan, Onaga Kan., Santa Cruz mountains and bred from *Halisidota agasizii* by Coquillett, Los Angeles Cal. [U. S. Nat. Mus.] There is a specimen from Pennsylvania and one from Texas in the Museum of Comparative Zoology, Cambridge Mass.

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Eremotylus glabratus Say

This species is apparently quite closely related to *Erem. arctiae* Ashm. and it is possible that this latter is a synonym of Say's species but that can be determined with certainty only by examining the type, which is apparently not in existence. A small example of *Erem. arctiae* corresponds very well indeed with the original description of this rare form. There is a cocoon in the Harris collection in the rooms of the Boston Society of Natural History, labeled "*Ophion glabratum*" but no

adult accompanies it though a specimen of *O. bilineatum* Say was in close proximity to the cocoon. There is apparently nothing in that collection which can be used in the identification of this species. A specimen in the United States national collection has been labeled by Dr Ashmead as *Eremotylus glabratus* Say. It corresponds very closely with the description of *Erem. arctiae*. The most apparent differences are in its small size and the comparatively slender marginal or radial nervure with no distinct angle or tooth near the stigma, a character which is usually well marked in both *Erem. macrurus* Linn. and *Erem. arctiae*.

This species has undoubtedly been erroneously identified in a number of collections and the following references, except that of its original describer, in all probability relate to something else. Prof. G. C. Davis some years ago informed me that but one individual of this species was known to be in existence and that was in his possession. Say's original description of this insect is reproduced below:

Honey yellow; a glabrous spot in the large cubital cellule.

Body dull honey yellow; head bright yellow; antennae, mouth and stemmata honey-yellow; eyes blackish; wings, first cubital cellule beyond its middle with a longitudinally oval glabrous space, but destitute of any opaque spot; metathorax transversely wrinkled near the petiole of the abdomen.

Length about $\frac{4}{5}$ inch.

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Table for separation of species of *Eniscophilus*

- a Larger chitinous spot in glabrous area of cubitodiscoidal cell, not appendiculate..... *purgatus* Say
 aa Larger chitinous spot in glabrous area of cubitodiscoidal cell, appendiculate

- b Chitinous process extending from larger chitinous spot along the posterior margin of the glabrous area and partly around its distal portion. Male clasps obtusely rounded.....*arcuatus* Felt
- bb Chitinous process from the larger spot not extending beyond the middle of the glabrous area. Smaller chitinous spot nearly circular and slightly posterior to the center of the glabrous area....
appendiculatus Felt

Eniscopilus purgatus Say

This species is easily recognized by the two opaque, chitinous spots in the cubitodiscoidal cell. The great tenuity and length of the basal two abdominal segments is very marked, and is frequently of service in identifying the insect, though this is also true of the much rarer *Enis. arcuatus* and *Enis. appendiculatus*. It is the species of this genus most frequently found in the East while collecting in the daytime and the one most common in collections.

Life history and habits. The imagos fly from the last of June till the last of September. They are diurnal and probably crepuscular in habit since they are attracted to lights to a certain extent, as is shown by the trap lantern experiments conducted at the Cornell University Agricultural Experiment Station in 1889.

Trap lantern records

	1889																	1892						
	JUNE				JULY								AUG.				SEP.			Total	JULY		AUG.	Total
	20	22	26	28	1	5	18	20	21	23	24	15	20	21	27	8	11	14	12		30	19		
Male	1	...	...	...	1	...	...	...	...	1	...	...	...	...	...	...	...	...	3	...	1	.....	1	
Female ..	1	1	2	1	...	1	1	2	2	...	1	1	1	2	1	1	1	1	20	1	....	2	3	

It will be seen by examining the record for 1889, that there are three distinct periods, separated by a space of about two weeks, in which this species was taken. Thus none were captured between July 5 and 18, July 24 and Aug. 15. These two non-productive periods may have been caused by climatic conditions, though it is hardly probable that unfavorable weather of any kind would prevent the species from flying by night for 13 consecutive days, to say nothing of the other period of three weeks. It may be that this periodicity indicates three broods or at least

periods when the imagos are more abundant, but in the absence of more data nothing but a surmise can be advanced.

The large number of females taken in the trap lantern reduces its value as a means of destroying noxious insects. Dr Packard observed that the bean-shaped egg of this insect was attached to the skin of the larval host by a pedicle, and that the newly hatched grub does not entirely leave the eggshell till it has eaten a hole into the side of its victim. It would therefore appear as though the sharpness of the ovipositor was largely for defensive purposes. The females can inflict a slight sting that will smart for half a minute or more, but the pain is by no means severe.

Hosts. This insect has been most frequently brought to notice as a parasite of the very destructive army worm, *Helio phila unipuncta* Haw. on which it is a very efficient check. The army worm was abundant in many localities throughout the country in 1896, when the numerous oblong, silken cocoons of this parasite attracted Professor Luggers' attention in Minnesota fields infested by army worms. This is the best evidence obtainable of its value as a parasite. We have reared it from the zebra caterpillar, *Mamestra picta* Harr. another injurious species, the grub emerging from the larva and pupating July 24, the adult appearing Sep. 13. Records indicate this to be one of the most valuable species of the genus, since it preys on several insects of considerable economic importance. It has been reared in addition to those named above, from *Mamestra trifolii* Rott, *Scoliopteryx libatrix* Linn., *Schizura concinna* Abb. & Sm., and *S. unicornis* Abb. & Sm. It has also been bred from a dipterous *Solidago* gall and several unidentified lepidopterous larvae. It probably has a number of other hosts. We have also seen a specimen reared from the *Polyphemus* caterpillar, *Telea polyphemus* Cram., in the Museum of Comparative Zoology at Cambridge Mass.

Description. Fulvo-ferruginous; stigma small; two subtriangular, opaque chitinous spots in the cubitodiscoidal cell.

Head medium; antennae nearly as long as the body; ocelli black, about equidistant from each other and the eyes; dorsal and posterior portions of head yellow; mandibles bidentate and tipped

with black. Thorax sericeous; mesothorax convex; scutellum and postscutellum prominent; metathorax slightly depressed anterior of the transverse carina; lateral carinae distinct. Wings hyaline; marginal nervure thickened and slightly sinuate near the stigma; cubitodiscoidal nervure usually strongly sinuate but not appendiculate, its bulla scarcely one fourth the width of the third discoidal cell from its apex; two subtriangular opaque spots occur in the glabrous area of the cubitodiscoidal cell, the larger one with no arcuate continuation along the margin of the glabrous area, though a small chitinous line may be seen near the smaller spot.

Legs honey yellow; abdomen strongly compressed, darker at the tip; first and second segments remarkably long and slender; claspers of male subtriangular, obliquely truncate, acute posteriorly.

Length about 22 mm, wing spread about 26 mm. Described from numerous examples.

The cocoon is a silken, brown, tough, oblong oval object.

Distribution. The recorded distribution of this insect is as follows: New England, New York, New Jersey, Pennsylvania, Virginia, Carolinas, Florida, Alabama, Illinois, Indiana, Missouri, Iowa, Colorado, Arizona, Nevada, California and Canada. Examples of this species from Georgia, Oregon and Washington, in addition to some of the states named above, occur in the collection of the Academy of Natural Sciences at Philadelphia. Specimens of this species are now before the writer from the following localities: Kansas; California; Virginia; Fox Point, Alaska [Harri-man Expedition '99]; Flatbush N. Y., Victoria Tex., St Louis Mo., Durham N. H., and Arizona, all being in the collections of the United States National Museum. Specimens from Colorado, Las Vegas N. M., Cheyenne Wy., and Michigan were lent to the writer by Professor Gillette. Specimens from New York were received from Mr L. H. Joutel, and Mr W. W. Harrington kindly sent examples from Grimsby Ont. (taken June 6), Toronto (taken July 27, Aug. 24 and Sep. 3), Winnipeg (taken in June), Osoyoos B. C. (taken in May) and from Ottawa, Canada. Specimens from Malden and Amherst Mass. (taken Aug. 1, 2, 12 and 21) were lent to us by Prof. C. H. Fernald. The species is doubtless distributed over the whole of the United States and the larger portion of Canada.

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Eniscopilus arcuatus Felt

This comparatively rare species may be easily separated from *E. purgatus* Say, with which it has heretofore been confused, by the well marked chitinous, usually yellowish, arcuate continuation of the larger opaque spot in the cubitodiscoidal cell. This structure extends along the posterior border of the glabrous area in that cell to a point beyond the smaller opaque spot. It may also be recognized by the bulla of the cubitodiscoidal cell being at a distance equal to one half the width of the third discoidal cell from the apex of the same [pl. 1].

This species was described in the February issue of *Psyche*, 1902, page 307-8, and its characterization is reproduced herewith:

Light fulvo-ferruginous, the larger opaque chitinous spot of the cubitodiscoidal cell with a distinct arcuate continuation extending along the hinder margin of the glabrous area and partly around the smaller chitinous spot.

Head medium, yellowish posteriorly, face yellowish, antennae slightly longer than the body; ocelli black, equidistant; mandibles bidentate, fuscus apically. Thorax, sericeous; mesothorax, convex; scutellum and postscutellum, prominent, the former yellowish; metathorax slightly depressed in front of the transverse carina; lateral carinae distinct. Wings hyaline, having hardly a trace of the fuscus visible in *Ophion* (*Eniscopilus*) *purgatus* Say; marginal nervure slightly thickened and sinuate near the small stigma; cubitodiscoidal nervure, weakly sinuate, not appendiculate; its bulla one half the width of the third discoidal cell from its apex; two subtriangular opaque spots in the glabrous area of the cubitodiscoidal cell, the larger one with a chitinous, usually yellowish continuation along the hinder margin of the glabrous area to a point beyond the smaller chitinous spot, which latter is anterior and lateral of the center of the glabrous area. Legs, honey yellow. Abdomen, strongly compressed, slightly darker at the tip, the first and second segments being very slender. The claspers of the male are rounded apically.

Length about 23 mm. Wing spread from 30 to 35 mm.

Habitat, Albany N. Y. May 6, 1876 [W. M. Hill]; Ithaca N. Y., July 16, 1889 [J. M. Stedman]; New York city [L. H. Joutel]; Malden Mass. [C. H. Fernald]; Poughkeepsie N. Y. [Young, collector]; South Britain Ct. 1884 [G. F. Pierce].

There are examples of this species from Cambridge Mass. in the collection of the Museum of Comparative Zoology, and from Georgia and New Hampshire in the collection of the Academy of Natural Sciences of Philadelphia. There is a specimen in the collections of the United States National Museum labeled "Coll. C. V. Riley," and one in the Bolter Collection at the University of Illinois from Illinois. Types are in the New York State Museum and also at Cornell University.

Eniscopilus appendiculatus Felt

This form is even rarer than the preceding. It was originally described from one specimen which came into my possession through the kindness of Dr J. B. Smith, New Brunswick N. J. This specimen probably came from New Jersey and is deposited as a type in the New York State Museum. A study of the collections of others has revealed two specimens in the collections of the United States National Museum, one marked "Collection C. V. Riley" and the other "From Selma, October 1880, W. H. Patton." This form is evidently southern in its habitat and it may be separated from the preceding species by the following characteristics which were given in the February issue of *Psyche*, 1902, page 308:

Light fulvo-ferruginous, larger opaque spot of the cubitodiscoidal cell with a small extension on its posterior angle. The smaller chitinous spot is nearly circular, light yellow in color and slightly posterior to the center of the glabrous area [pl. 2, fig. 4].

This species differs in addition to the above characteristics from the preceding one in having the cubitodiscoidal nervure slightly angled and not sinuate. It is a smaller form, having a length of 18 mm and a wing spread of about 27 mm.

Table of species of *Ophion*

a Wings hyaline

b Body usually strongly compressed, eyes large, extending nearly to the base of the mandibles

c Medium size, metathorax not areolated, male clasp subtriangular *bilineatum* Say

cc Small, metathorax usually strongly areolated, male clasp short, rounded apically..... *tityri* Pack.

bb Body stout, not strongly compressed, eyes small, distant from base of mandibles

- c* Cubitodiscoidal nervure usually not appendiculate
d Ferruginous or fulvous.....*bifoveolatum* Brullé
dd Ferruginous varied with black and venter of mesothorax usually black*nigrovarium* Prov.
cc Cubitodiscoidal nervure appendiculate, appendix extending into second discoidal cell*abnormum* Felt
aa Wings subhyaline
b Wings distinctly ferruginous*ferruginipennis* Felt
bb Wings yellowish, fuscous along apical costal margin...*costale* Cress

Ophion bilineatum Say

Two-lined Ophion

This species, next to the long-tailed and purged Ophions, is the most abundant in collections and the one most frequently noticed in entomologic literature. It may be easily separated from the other more common forms by its medium to large size, strongly compressed abdomen, by the subtriangular, obliquely truncate male clasps and the appendiculate cubitodiscoidal nervure.

Life history and habits. Very little is recorded concerning the life history and habits of this species. Its comparative rarity in collections is probably explained by its crepuscular or nocturnal habits, since our trap lantern record indicates that it is one of the most abundant forms attracted to light.

Trap lantern records

1889																															
	JUNE		JULY	AUGUST											SEPTEMBER																
	4	30	3	1	4	21	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	11	12	13	14	15	16	17	18	19
Male....	...	1	.....	..	..	..	1	..	..	..	..	1	1	2	..	2	..	1	..	1	..	4	2	..	1	..	2	..	4	..	
Female..	1	...	1	1	1	1	3	1	4	4	4	1	1	5	12	20	6	8	9	1	3	13	3	8	37	32	14	12	59	17	25

1889																1892															
SEPTEMBER												OCT.				AUG.		Total	MAY	JUNE	SEPTEMBER										Total
20	21	22	23	24	25	26	27	28	29	30	1	2	5	10	22	20	28				11	14	16	19	20	23	24	25	30		
Male...	..	1	..	..	..	2	3	..	..	..	1	..	..	..	.....	30	.....	1	1	..	..	..	..	..	..	..	..	2			
Female	21	14	2	1	7	18	17	2	3	3	11	9	1	1	1	2	420	3	.....	..	2	1	1	1	1	2	1	1	13		

It will be seen by the above, that there is some indication of periodicity in the captures, though nothing but what might be caused by more or less favorable weather or the relative abundance of the insects. There is certainly no indication of more than one brood. It will be noticed that this species flies most abundantly from about the middle to the last of September, and may be found on the wing till nearly the middle of October.

Hosts. Very little is known regarding the species on which this insect preys. The record is so meager that one can only surmise as to the economic value of this parasite. It has been reared from *Diacrisia virginica* Fabr. *Feltia gladiaria* Morrison, and *Glaea inulta* Grote. Dr Howard has recorded this species as possibly a parasite infesting *Notolophus leucostigma* Abb. & Sm. to a limited extent. This brief record suggests that this species may be parasitic on some of the arctians and noctuids, and while the former are not of much economic importance, such is not true of many of the latter, and in the control of these, this species may play an important part.

Description. Fulvo-ferruginous, stigma well developed, medium size to rather large; length of body about 19 mm; wing spread about 30 mm.

Head medium, antennae as long or longer than the body; eyes and ocelli black; lateral ocelli a little distant from the eyes; dorsal and dorsocaudal aspect of head yellowish; mandibles bidentate and tipped with black. Mesothorax convex; scutellum and postscutellum prominent; metathorax with inconstant raised lines. Wings hyaline with a glabrous elliptic spot near the stigma in the cubitodiscoidal cell; cubitodiscoidal nervure appendiculate [pl.2, fig.3], legs honey yellow. Abdomen rather strongly compressed, frequently a little darker at the extremity; male claspers subtriangular, obliquely truncate, and acute posteriorly.

Described from numerous specimens.

There are some very small representatives of this species from the Adirondack mountains that approach closely in size and general appearance the following form. They may be separated, however, by the relatively shorter, more compressed abdomen and by the thorax being as dark as other portions of the body.

Distribution. This insect has a wide distribution over the United States and the southern portion of Canada, though it has

not been reported from every state in the Union. Its recorded distribution is as follows: New England, New York, New Jersey, Virginia, Maryland, District of Columbia, Florida, Louisiana, Michigan, Iowa, Missouri, Colorado, Texas, Montana, Nevada, Lake Winnipeg and Sudbury, Ontario.

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 1882 Packard, A. S. Bost. Soc. Nat. Hist. Proc. 21:19 (*O. tityri* separated from this species)
 1883 Saunders, William. Ins. Inj. Fruits, p.273, fig.282 (Parasite of *Spilosoma virginica*)
 1888 Lintner, J. A. Ins. N. Y. 4th Rep't, p.205 (At Coeyman N. Y.)
 1889 Seudder, S. H. Butterflies of N. Eng. 3:1880, pl.88, fig.8 (*O. tityri* supposed to be a variety)
 1890 Riley, C. V. & Howard, L. O. Insect Life, 3:155 (Bred from *Glaea inulta* and *Agrotis morrisoniana*, *habitat*)
 1890 Ashmead, W. H. Col. Biol. Ass'n Bul. 1, p.43 (Listed)
 1890 Perkins, C. H. Vt. State Bd. Agric. 11th Rep't, separate, p.10 (Mention)
 1890 Smith, J. B. Cat. Ins. N. J. p.25 (Not common at Caldwell)
 1891 Harrington, W. H. Ent. Soc. Ont. 21st Rep't, p.67 (Parasite of white miller moths)
 1892 Osborn, Herbert. Part. Cat. Animals Ia. p.15 (Common)
 1896 Evans, J. D. Can. Ent. 28:10 (Listed)
 1897 Howard, L. O. U. S. Dep't Agric. Div. Ent. Bul. 5, Tech. Ser. p.30 (Possibly a parasite of *Orgyia leucostigma*)

Ophion tityri Pack.

This species resembles *O. bilineatum* Say closely in its general appearance, and it may be an earlier occurring dimor

phic form but we have no evidence of this and for the present it must be regarded as a distinct species. It may be separated from the preceding by its smaller size, relatively shorter and flatter abdomen, and by the difference in the form of the male genitalia.

Life history and habits. Comparatively little is known of the life history and habits of this insect, since it has been so frequently confused with *O. bilineatum*. There appears to be but one published notice of this parasite since its description in 1882, and in that it is not recognized as a distinct form. This species can hardly be regarded as rare, since over 100 individuals were taken in the trap lantern experiments at Cornell University and it has been frequently collected by the writer and also met with in other collections.

Trap lantern records

	1889																		
	MAY																		
	5	7	8	9	10	11	14	15	16	17	18	19	20	21	22	24	25	26	28
Male .....	.....	.....	1	.....	.....	1	2	1	2	2	4	10	2	1	2	1	3	2	1
Female ...	1	1	1	3	1	1	3	1	9	4	1	7	3	4	1	3	3	3	....

	1889																				
	JUNE														JULY					AUG.	
	2	3	4	5	6	8	11	13	16	17	19	27	29	1	2	3	23	31	1	2	17
Male .....	.....	1	.....	.....	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....
Female ..	2	2	1	1	2	1	1	1	2	2	1	1	2	1	1	1	3	1	2	1	1

	1889			1892																				Total
	SEP.		Total	MAY	JUNE								JULY								AUG.			
	27	30			1	2	4	5	9	19	21	28	1	6	16	17	25	26	28	2	6			
Male .....	.....	.....	39	.....	1	1	1	1	1	...	...	...	...	...	2	...	...	...	...	...	7			
Female ..	1	1	79	1	...	1	1	...	...	3	1	1	1	1	...	1	1	1	1	1	16			

A glance at the above table will show that this insect has a well defined period of flight, and one that does not overlap the time *O. bilineatum* is abroad, except in the case of scattering individuals. This species appears early in May, is most abundant the latter part of the month, and occurs somewhat rarely during June with belated individuals in July, August and September, while *O. bilineatum* does not occur till August and then only in scattering numbers till the latter part of the month. This marked difference in the time of flight between these two parasites indicates that either they are two broods of the same insect or else that they are distinct species. The structural difference to be described later must be regarded as proofs of their distinctness. The large eyes and many individuals taken in the trap lantern indicate a crepuscular or nocturnal habit.

Hosts. This parasite has been reared from *Epargyreus tityrus* Fabr. Prof. G. C. Davis, when at the Michigan Agricultural College Experiment Station, wrote us that he had bred the insect repeatedly from *Halisidota caryae* Harris and *Symmerista albifrons* Abb. & Sm. It is probably parasitic on a number of other related insects.

Description. Ferruginous or fulvo-ferruginous with frequently a decidedly fulvous tinge on the thorax, which latter is shorter and the abdomen considerably shorter than in *O. bilineatus*.

Face ferruginous, or laterally fulvous; head medium; mandibles bidentate, tipped with dark brown, clypeal fossae deep, antennae usually longer than the body; the fossae at their bases not deep; eyes large, reaching nearly to the base of the mandibles. Ocelli black, nearly contiguous and the posterior close to the eyes. Thorax short, ferruginous or fulvo-ferruginous; mesothorax convex; scutellum and postscutellum prominent; metathorax usually with very prominent carinae inclosing deep, four sided areas, and the pedicel of the abdomen surrounded by a high carina. Wings hyaline; cubitodiscoidal nervure strongly appendiculate. First recurrent nervure only about one third the length of the second; bulla of the latter close to the cubitodiscoidal nervure, and that of the latter nearer the second discoidal nervure than the appendix. Legs long, fulvo-ferruginous; abdomen much shorter than in *O. bilineatus*, very strongly compressed and the posterior segments usually darker in color. Clasps of male subtriangular, obtusely rounded, length 14 mm, wing spread 26 to 30 mm. Described from numerous specimens of both sexes.

Distribution. This species is widely and probably generally distributed in the northern United States and southern Canada. It was described from Massachusetts, has been met with in numbers at both Albany and Ithaca N. Y. and was repeatedly reared by Professor Davis in Michigan. In addition we have specimens before us from New York city [Joutel]; Ottawa, May 19, 24 and June 8, Toronto, August 24, Grimsby, June 6, Port Hope, May 5, and Vancouver Island, May 3, all from Canada through the kindness of Mr W. H. Harrington.

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Ophion bifoveolatum Brullé

This species is one of the more common forms belonging to the genus and if one may judge from trap lantern records, it is largely diurnal and not crepuscular or nocturnal as in the case of some of its close allies. This conclusion is further borne out by the reduced size of the eyes, being decidedly smaller than in related species and distant from the mandibles. This species occurred in the trap lantern material taken at Ithaca in very small numbers compared to those of the closely allied *Ophion bilineatum* Say. It has a somewhat exceptional host in white grubs, compared with other members of the genus and so far as known to us has not been reared from any other species.

Description. Fulvo-ferruginous with small eyes distant from mouth; costal vein inclined to black; cubitodiscoidal nervure rarely appendiculate; bulla of the second recurrent nervure usually close to tip of cubitodiscoidal nervure and abdomen less compressed than in its close allies.

Head medium; face frequently fulvous laterally, broad; mandibles stout with black tips; clypeal fossae deep and usually black; antennae dark brown, stout and not as long as the body; ocelli black and equidistant. Thorax sometimes dark brown, finely punctured and with sutures more or less black; mesothorax convex; scutellum and postscutellum prominent, the former sometimes a light ferruginous; dorsum of metathorax is usually smooth. Wings hyaline; stigma well developed; costal

and adjacent veins inclined to black; cubitodiscoidal vein usually smoothly arched and rarely appendiculate; bulla of second recurrent nervure usually close to tip of cubitodiscoidal nervure [pl. 2, fig. 2]. Legs uniformly ferruginous; claws pectinate. Abdomen sometimes slightly darker at tip and not strongly compressed but relatively thicker and shorter. Male clasps stout, rather long, obliquely rounded and rather acute at tip.

Length about 15 mm. Wing spread about 28 mm.

This species occurs abroad during the latter part of May and very early in June. Specimens are at hand from Ottawa, Canada taken May 30 and June 6 [Harrington]; Fort Lee N.J. taken May 29 [Joutel]; Malden Mass. taken May 4 [Fernald]; Belfrage Tex., Washington D.C., taken in May [United States National Museum] besides various New York localities. This species has been recorded from the following localities: Mt Washington N. H., New Jersey, New York, Illinois, Iowa, Colorado and Texas. The record of captures in trap lanterns at Ithaca in 1889 and 1892 is given below:

Trap lantern records

	1889								1892										
	MAY		JUNE					Total	MAY	JUNE								Total	
			24	26	3	4	8			21	26	30	1	2	3	8	11		16
Male											1				1	1		...	3
Female	1	1	1	1	1	1	1	7	3	2	1	2	1	1	1	1	1	1	13

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Ophion nigrovarium Prov.

This species is undoubtedly closely related to the preceding form, though we have been unable to examine the original type. A few specimens from Colorado which we provisionally assigned to *O. bifoveolatum*, are exceptionally highly colored, and they probably belong to this species; in which event we are inclined to believe that it is but a variety of the preceding. A translation of the original description is as follows:

♂ Length .6 inch (pouce). Yellowish red varied with black. Head yellow; base and tip of the mandibles, two punctures on the top of the clypeus, the fossa at the insertion of the antennae, with the eyes are of a more or less deep brown. Eyes short, with almost no slope above. Posterior ocelli distant from each other, but close to the eyes. Antennae stout and short, brown. A puncture before the tegulae; the scutellum pale yellow. Thorax yellow; superior border of the prothorax, base of the scutellum, base of the metathorax, its sutures, upper sides of mesothorax, base of the four posterior coxae, black. Metathorax without distinct carinae. Wings slightly smoky; costal nervures brown, stigma yellow. Feet yellow, the anterior coxae in front and the posterior coxae behind more or less spotted with brown. First and second segments of abdomen brown; the posterior segment also brown on the inferior border.

♀ Of a clearer yellow than the ♂. Coxae entirely yellow, except in their articulation with the body. Base and extremity of abdomen of a deep shade of brown. Otherwise like the male. Described from two specimens. Inhabits Canada. [*Nat. Can.* 6:104]

Ophion abnormum n.sp.

A single specimen of this form was received from Colorado through the kindness of Prof. C. P. Gillette, who labeled it no. 2103. This species is very closely allied to what we have considered a light form of *O. bifoveolatum* Brullé.

Description. Fulvous, with indistinct ferruginous markings on the thorax and abdomen, except that the dorsum of the thorax has two distinct submedian fulvous lines and its lateral margins are also bordered by stripes of the same color. Wing spread 18 mm, length of body about 15 mm.

Head medium, face short, mandibles bidentate, tipped with dark brown or black; clypeal fossae deep, dark brown; antennae slightly shorter than the body; eyes black, small, somewhat dis-

tant from the mandibles. Ocelli glassy or black, well separated and the posterior ones distant from the eyes; thorax glassy; mesothorax convex; scutellum and postscutellum conspicuous; metathorax evenly rounded with no carinae. Wings hyaline; nervures and stigma brown, the latter with fulvous markings; cubitodiscoidal nervure plainly appendiculate, the appendix extending into the second discoidal cell; bulla of second recurrent nervure close to the cubitodiscoidal nervure, and that of the latter nearly equally distant between the appendix and the second recurrent nervure [pl. 2, fig. 5]. Legs ferruginous; claws pectinate; abdomen stout, not strongly compressed.

Described from one female from Colorado.

Ophion ferruginipennis n. sp.

One example of this unique form was in the collection of the United States National Museum and through the kind forbearance of Dr Ashmead its characterization has fallen on the writer. Another specimen was taken by Mr L. H. Joutel in the vicinity of New York city.

Description. Ferruginous; wings ferruginous and with a spread of about 40 mm; metathorax strongly areolated in much the same way as in *O. tityri* Pack.

Head medium; mandibles bidentate; black apically; clypeal fossae deep; antennae nearly as long as the body. The fossae at their bases are well marked. Eyes large, extending nearly to the mandibles; ocelli black and the posterior pair almost contiguous to the eyes; thorax sericeous; mesothorax convex; scutellum and postscutellum prominent. Metathorax with two well developed transverse carinae and a number of longitudinal ones radiating from the insertion of the first abdominal segment. Wings subhyaline with a distinct ferruginous and, in places, fuscous tinge, specially at their base and along the anterior margins. Cubitodiscoidal vein with its appended vein stub extending one third across the cell from the well marked angle; bulla of second recurrent nervure a little distance from the cubitodiscoidal vein [pl. 2, fig. 1]. Legs light ferruginous, concolorous; claws pectinate; abdomen strongly compressed and somewhat darker at the tip. Length about 25mm, wing spread about 40 mm.

Described from two females. One is in the collection of the United States National Museum and the other in the New York State Museum.

Ophion costale Cresson¹

This rare species is represented by only one individual, the type being in Mr Cresson's collection. It may be that this form is but a sport, though at present we can do no better than to allow it to stand as a distinct species.

Description. Female. "Fulvo-ferruginous, shining, face broad, the middle closely punctured, subtuberculate immediately beneath base of antennae; clypeus strongly punctured, tips truncate, lateral sutures and tips of mandibles black; cheeks swollen; antennae shorter than usual, reaching about to tip of second abdominal segment; mesothorax convex, polished; scutellum very convex; metathorax confluent punctured, without transverse carina, sutures of thorax narrowly black; wings subhyaline, stained with yellowish at base and with fuscous along apical costal margin, darkest at tip of marginal cell; basal margin of third and fourth abdominal and an oblique mark on sides of second segment, black." Length 13 mm. Habitat: Klamath county, Cal.

"Readily distinguished from all other species known to me by the ornamentation of the wings." [Cresson]

Genophion n. gen.

This genus is proposed to include certain forms remarkable for the development of the lower portions of the head, resulting in a very elongate face and considerable distance between the normal sized eye and the base of the mandible. This is specially marked in *Genophion gilletti* Felt, the generic type.

Table of species

<i>a</i> Wings fulvo-fuliginous	<i>gilletti</i> Felt
<i>aa</i> Wings with a distinct fulvous tinge.....	<i>coloradensis</i> Felt

Genophion gilletti n. sp.

This small form resembles *O. coloradensis* Felt, but may be easily separated from it by its shorter antennae, longer face and the dark fuscous coloration of the wings. It is described from one female from Colorado, no. 2565, kindly sent me by Prof. C. P. Gillette, in whose honor it is named.

Description. Dark ferruginous, with the head and thoracic sutures black and the wings tinged with dark fuscous. Wing spread about 18 mm, length of body 9 mm.

¹1878 Cresson, E. T. Acad. Nat. Sci. Phila. Proc. p.366.

Head large, face very long with a large, evenly rounded labrum; mandibles stout, bidentate, tipped with dark brown or black, and with black at the extreme base; clypeal fossae black and almost connected with the base of the mandibles by black impressed lines; antennae shorter than the body, stout and with the first joint of the flagellum much longer and more slender than the second; antennal fossae ringed with black and with a conspicuous, impressed, black area above; eyes rather small, distant from the base of the mandibles; ocelli glassy or black, the two lateral distant from the eyes and each connected therewith by a deep, impressed, black line. Thorax glassy with deeply impressed, jet-black sutures; mesothorax highly convex; scutellum and post-scutellum prominent; metathorax smoothly rounded and with no well developed carinae. Wings distinctly fulvo-ferruginous; cubitodiscoidal nervure uniformly arching, not appendiculate; first recurrent nervure less than one fourth the length of the second; bulla of the second recurrent nervure close to the cubitodiscoidal nervure, and that of the latter distant from the second discoidal nervure by one half its length. Legs uniformly ferruginous, except the trochanter segments which are black at their base; claws pectinate; abdomen strongly compressed, first segment slender and gradually enlarging at its apical fourth.

Genophion coloradensis n. sp.

This is a small form having somewhat the general appearance of *O. tityri* Pack., but differing from it in a number of particulars. It is described from two female specimens in the collection of the United States National Museum.

Description. Ferruginous with the thoracic sutures black, wings tinged with fulvous, wing spread 20 mm, length 9 mm.

Head medium; face long; mandibles bidentate, tipped with dark brown or black; clypeal fossae deep, dark brown; antennae about as long as the body, the fossae at their bases well marked and ringed with dark brown. Eyes medium, distant from the mandibles. Ocelli glassy or black, nearly contiguous, distant from the eyes; thorax sericeous, with black sutures; mesothorax convex; scutellum and postscutellum prominent. Metathorax with three well developed carinae, one dorsal, two lateral, radiating from the insertion of the first abdominal segment. Wings subhyaline, with a distinct fulvous tinge, specially on the hind wings. Cubitodiscoidal vein variably appendiculate (in one only a notch and in the other well marked); first recurrent nervure less than one half the length of the second; bulla of second recurrent nervure near cubitodiscoidal nervure, that of the latter at

proximal third of distance from the appendix to the second recurrent nervure. Legs light ferruginous, basal articulations variably marked with dark brown, claws pectinate. Abdomen strongly compressed, first segment slender, gradually enlarging at apical third.

Described from two females from Colorado.

INJURIOUS INSECTS

Chrysanthemum lace bug

Corythuca marmorata Uhler

Ord. Hemiptera Family Tingitidae

Members of this family have been characterized by Professor Comstock, in the following terms: "Dainty as fairy brides are these tiny, lace-draped insects. One glance at the fine, white meshes that cover the wings and spined thorax is sufficient to distinguish them from all other insects, for these are the only ones that are clothed from head to foot in a fine white Brussels net." This very fitting description applies to all members of the family, and where such insects are found on chrysanthemums, they are very likely to be this species. This group is not only unusual in appearance, but is also one rarely brought to the attention of the economic entomologist. This is particularly true of the species under consideration, concerning which comparatively little is known. It was described in 1878 from North Carolina but with no indication of its food habits. The next record appears in 1898 and relates to an attack the preceding year on chrysanthemums in Alabama.

This insect was brought to our notice last July by Mr Harry Blauvelt of Coeyman, who stated that it had caused considerable injury the past two or three years, and that he feared a repetition of the attack this season. His brother, Mr Egbert Blauvelt, observed that it bred abundantly on ragweed and also on some other which he was unable to identify. Specimens of the insect were colonized on potted plants and the accuracy of the complaint established beyond question. The little pests fed vigorously on the foliage, laid numerous eggs, many young developed and soon

one plant after another assumed an unhealthy appearance and died. The attack was characterized in particular by a discoloration of the leaves accompanied by a dark spotting, due to excrement, and the cast skins of the young were also abundant. The general appearance of a badly infested leaf is shown on plate 3.

Life history. The breeding of this insect was placed in Mr C. M. Walker's charge, but owing to pressure of other work he was unable to give it all the attention desirable. He learned, however, that the eggs were laid on the underside of the leaf, being thrust under the epidermis along the larger leaves and veins, leaving only the small, yellowish, conical cap in sight. The eggs soon hatch and the young develop rapidly, since between June 11 and 23 a life cycle was nearly completed. The feeding of the insect causes white, irregular blotches to appear, and if the attack is at all severe, withering of the leaves. The various molts follow each other quickly and the cast skins soon become so abundant as to give the impression of a bad infestation, whereas only a few bugs may be present. The insects are very active and pass readily from one plant to another, though none of the adults were observed to fly.

Description. This species has been the object of considerable study, and the following descriptions and the original illustrations were made under our direction by Mr C. M. Walker. It is believed that all stages are described below though they were not obtained by close breeding.

Egg [pl.4, fig.1]. Length about .5 mm, width .25 mm. Ovate, somewhat fusiform; visible tip truncate, collared, within which is a small, yellowish, ridged conical cap which is displaced by the young when it emerges.

Stage 1. Length .5 mm, breadth one third of length; antennae stout, with numerous long spines; three segmented, the terminal segment being about twice the combined length of the first and second. Legs stout, and about as long as the insect. There are simple spines arising directly from the body [pl.4, fig.2b], and also much shorter, compound ones originating from cone-shaped bases [pl.4, fig.2a]. Each abdominal segment bears on its lateral margin a single somewhat trumpet-shaped, compound spine on a conical base [pl.4, fig.3]. Two oval openings occur on the dorsal line of the posterior margin of the third and fourth abdominal segments. These may possibly be analogous to the odoriferous glands which occur in certain other species of Heteroptera.

Stage 2 [pl.4, fig.4]. Length 1 mm, width .4 mm. Form broader in proportion to length than in the first stage, and the legs are much shorter. The chief difference between this and the preceding stage, is in the size and number of spines. The dorsal, compound spines, which in stage 1 arose from conical bases, have become much thickened, taper to a point and are about one fourth the length of their bases, which latter are enormously developed and thickly studded with chitinous projections [pl.4, fig.5a]. The long simple spines arising directly from the body, are shorter and their bases narrow [pl.4, fig.5b]. The marginal, compound spines of each abdominal segment have lost all resemblance to their previous form. Their rugose, spined bases have become thickened and are about twice the length of the spine, which latter is narrowed to a sharp point.

Stage 3. Length 1 mm, width .5 mm. The terminal segment of the antenna is about two and one half times the combined length of segments 1 and 2. In this stage the compound dorsal spines mentioned in the preceding have apparently suffered little change, but their bases have increased five times the length of the spines, and are correspondingly stouter and rougher [pl.4, fig.7a]. The simple spines situated near these latter have not changed much, though they are somewhat longer than in stage 2 [pl.4, fig.7b]. The bases of the lateral abdominal, compound spines are four times the length of the spines [pl.4, fig.8a], which latter have not changed in appearance. Contiguous to these, singly or in pairs, are other shorter compound spines on conical projections about twice their own length [pl.4, fig.8b].

Stage 4 [pl.4, fig.9]. Length 1.5 mm, width .75 mm. Form ovate, tapering anteriorly. Head nearly as wide as long, obtusely rounded with the lateral margins behind the eyes arcuate, hind angles rounded. Antennae four segmented, segment 3 a little longer than the fourth, which is about equal to the combined length of 1 and 2, the last being about one half the length of the first. Rostrum stout, dark at tip and extending to about the base of the first abdominal segment. Head, bearing four groups of compound spines on tubercles or bases of varying size and length arranged as follows: a median pair at the anterior margin; three directly back of these, the central one being smaller; two groups of five of various lengths, each a little behind the eye and halfway between the median line and the lateral margin. A long simple spine is also found at the base of each of these groups.

Prothorax tapering anteriorly, three times as broad as long; with two median pairs of grouped compound spines at about equal distance from the anterior and posterior margins, the anterior pair with two smaller spines at their bases. Laterally there is a group of three compound spines at the apical angle

of the prothorax, the central one largest, and another of five at the posterior angle, three being much larger than the others. The wing pads are seen for the first time and extend to the anterior margin of the second abdominal segment. There are two sublateral groups, each consisting of two compound spines, one larger, one smaller and a simple one, near the posterior margin of the mesothorax. The anterior lateral margin is armed with a stout spine similar to that on the preceding segment, and on the posterior angle there is a group of five compound spines similar to those on the prothorax.

The abdomen consists of 10 segments, numbers 2 and 3 having a single lateral spine, while segments 4 to 8 are each ornamented with lateral groups of three compound spines [pl.4, fig.10], one being nearly twice the length of the other two. Segment 9 bears only one on each side. There is also a slender, hairlike spine of considerable length at the base of each group of spines on segments 2 to 8. Segments 2, 5, 6, 8 and 9 each bear a median pair of long, stout, compound spines [pl.4, fig.11a], each of which, with the exception of those on segments 2 and 9, has a simple spine at its base [pl.4, fig.11b]. The so called odoriferous glands appear as in the younger stages on the dorsum of the third and fourth segments. Certain extremely minute projections, with enlarged extremities are scattered over the body, arising directly from its surface. There are also more numerous chitinous points generally distributed and which give the body a brownish appearance.

Stage 5. Length about 2 mm, width nearly 1 mm. The first two segments of the antennae are about equal in length. The third is longest and not quite twice the length of the fourth [pl.4, fig.13]. The wing pads extend to the fifth segment of the abdomen, which latter is nearly fusiform, tapering anteriorly from the extremity of the wing cases. The dorsal spines are relatively much larger and more specialized and the lateral groups on the thorax and abdomen, excepting the last segment of the latter, are distinctly pediceled [pl.4, fig.12]. This is also true of the anterior median pair of the prothorax, which almost coalesce, and of the median pair of the mesothorax.

The original description of the adult is as follows: "Form similar to that of *T. arcuata* Say. Body black, the humeral region and pleural margins sometimes paler, or piceous; the venter polished, minutely, transversely wrinkled. Bucculae highly elevated, white; antennae slender, the apical joint sometimes dusky. Pronotal vesicle high, extending far forward, regularly arching over the head, abruptly compressed anteriorly for more than half its length; the meshes large, two larger ones occupying the basal breadth; the nervures more or less embrowned, that of the middle carinate, much elevated, entire.

Most of the nervures with short spines, which in some specimens are obsolete. Lateral lobes of pronotum short, prominent, semi-circular, having the same curve anteriorly as posteriorly; narrower than the base of the hemelytra, with large, rather regular cells; the nervures of the middle tinged with brown; a brown spot exteriorly and sometimes a second spot at the posterior margin; the marginal spines long and slender. Processus divided into cells as far as the tip; only the base of the lateral margin elevated, the middle carina high, not so high as the pronotal vesicle, gradually declining to the tip, the base arched, bearing two large areoles surmounted by a series of smaller ones, the upper edge spinous. Raised margin of the sternum whitish, the metasternum circular, auriculate each side. Legs pale honey yellow, embrowned at tip and on the tarsi. Hemelytra rather quadrangular, with the basal angles very acute, very widely removed from the pronotal lateral lobes, the basal margin distinctly concave; lateral margins spinous until a little beyond the middle, the tips widened, bluntly, broadly rounded; areoles large, next to the apical series is a transverse row of three or four very large ones, usually connected with another large one in front exteriorly; vesicular elevations small, with a high carina, spinous, bearing posteriorly a brown spot; a brown spot exteriorly near the basal angle, another submarginal near the middle, and a broad brown band at tip which omits the subapical series of large areoles.

Length, 3 mm. Breadth at base of hemelytra, $1\frac{1}{2}$ mm."

Remedies. This little pest being a sucking insect, can be controlled only in two ways. Clean culture will probably prove the most effective method of checking its depredations, since it would mean the destruction of weeds and various plants on which the insect could breed. There is little probability of the pest developing in large numbers if the vicinity of a chrysanthemum field is kept clear of weeds. The pest may be severely checked, if not nearly destroyed by thorough spraying with a whale oil soap solution, using 1 pound to 9 gallons of water, according to Mr Egbert Blauvelt. It is very probable that pyrethrum powder, or better still, hellebore could be used wherever a limited number of plants require treatment.

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NOTES FOR THE YEAR

The season of 1903 has been marked in particular by an unusually severe outbreak of plant lice of various species, some of which continued their depredations over an abnormally extended period. These insects were so destructive and generally present on various plants in different sections, that observations relating thereto have been grouped under a separate head. Species depredating on other plants and products of value, have been grouped under convenient headings for the purpose of facilitating ready reference to the various accounts.

Plant lice

The season of 1903 may well be remembered on account of the exceeding abundance of these little insects, particularly of species of economic importance. This is an exceedingly interesting group, and their almost absolute helplessness and enormous prolificacy illustrate one of nature's provisions against the extermination of a species. Despite their apparent weakness, these little creatures are well able to hold their own, as many farmers know to their cost. This group is at present represented in America by the relatively large number of 325 species, as given by Professor Hunter in a recently issued list.

The conditions which control the abundance of these forms are not well understood, though in all probability they are largely climatic, supplemented by the beneficial work of various natural enemies. Some believe that dry weather is favorable to the increase of these little insects, and others attribute their abnormal development to a certain amount of moisture. It is very probable that a protracted dry spell, if not accompanied by excessive dust, is favorable to the development of a large number of species, and that violent rains at intervals, specially if they occur before the foliage is curled by the work of the pests, is very destructive to these little creatures. On the other hand, it is quite possible that a certain amount of moisture is desirable, and that the reports of certain persons, who have noted a coincidence between the appearance of rains and the development of these forms, may be correct.

It is undoubtedly true that natural enemies, prominent among which are ladybugs, syrphus flies and lacewing flies, serve as very useful checks on this interesting group of insects. Repeated observations in different countries, and extending over a series of years, have demonstrated that these insects multiply enormously during periods when plant lice are unusually abundant, and though it may require some time for the natural enemies to overtake their hosts, this is bound to occur in course of time.

The attack of 1903 was not only characterized by excessive severity but also by an undue prolongation; and this latter may have been in part due to unusual rains, which were not favorable to the comparatively unsheltered natural enemies and hindered their gaining an ascendancy over their hosts. The explanation for this is that the plant lice, before the appearance of the rains, had ample opportunity to curl the leaves and therefore provide themselves with shelter from almost any inclement weather. These retreats afforded admirable breeding places from which the insects could emerge and attack adjacent foliage, so that the usual destructive influence of showers would be modified to a considerable extent; on the other hand, the larger predaceous enemies would hardly reap an equal benefit from this protection, and consequently would be delayed in gaining the ascendancy.

Appletree plant lice (*Aphis mali* Linn. and others). These species commonly occur in greater or less numbers throughout the orchards of the State, and their abnormal increase depends on favorable climatic or other conditions. Such was characteristic of the spring and early summer of 1903, and as a result injuries by these species were not only much more marked than usual but also prolonged to a much later date. The worst affected trees, which were usually young, presented a very characteristic appearance, and the injury was so severe that very little growth was possible. Such a large amount of honeydew was excreted that the foliage was almost entirely blackened, and an examination of many trees showed that the growing tips were literally covered by hungry plant lice anxious to reach a tender spot. The severity of the attack began to be evident about the last of May, and was more so in June, continuing in July, and in

some cases at least the plant lice were extremely abundant even to the middle of August. The worse infested trees lost a considerable portion of their foliage; the development of the fruit was severely checked in some instances and many trees were seriously injured. Complaints were received from a number of correspondents in different sections of the State, and almost every observer agreed in holding plant lice responsible for severe damage. Some quince bushes in Genesee county were reported by Mr J. F. Rose as bearing a mass of black, rolled leaves the latter part of June, and the observer in Dutchess county characterized the attack as being more severe than had been known for 10 years. The conditions in the nursery were no better than in the orchard, and a correspondent reports that plant lice obliged him to keep a gang of 15 or 20 men and boys at work continuously in the nursery with a whale oil soap solution, and some other nurserymen found themselves almost unable to cope with the insects, so severe and general was the injury.

Plant lice, as is well known, must be controlled by the use of contact insecticides, the most valuable of which for present purposes are a whale oil soap solution, tobacco water and kerosene emulsion. Some growers prefer the tobacco solution to any other and attribute greater effectiveness to it, while others have obtained excellent results with a whale oil soap solution. The latter, in the case of the appletree plant louse, should be used at a strength of 1 pound to 6 gallons of water, or even 1 to 4, and in any case great care should be exercised to secure thorough treatment. The kerosene emulsion may be used in the same way as the whale oil soap solution, and in case of severe attacks the standard emulsion may be diluted with but 6 or 7 parts of water, since it is better to scorch the foliage a little than to allow many of the insects to escape.

The severe and protracted injuries by plant lice led us to experiment with whale oil soap solution, 1 pound to 4 gallons, for the purpose of testing its effectiveness on the pest and also the liability of injuring the foliage. Apple twigs covered with the insects were dipped into the solution July 28, and on the 30th it

was found that all were killed, while repeated observations up to Sep. 8 failed to reveal any injury to the leaves. We are, however, inclined to believe that it is more important to make a very thorough application than to use a strong insecticide, and would therefore emphasize the former most strongly.

Cherry plant louse (*Myzus cerasi* Fabr.). This common species is likewise generally distributed throughout the State, and always occurs in greater or less numbers on cherrytrees. The past season has been marked by an excessive abundance of this insect, and in some cases sweet cherrytrees have been very seriously injured. We recall, for example, certain trees in Chautauqua county, which were so badly infested, that nearly one third of the leaf-bearing portion of twigs had the foliage so badly affected that it curled, died and dropped, and after a time new leaves were developed in their place. This injury was so great that one or two trees died, probably as an indirect result of the severe drain made on their vitality. The presence of these plant lice in large numbers began to be apparent the middle of May and continued through June and even into early July. Reports of injuries were received from a number of counties in widely separated sections of the State, and were also observed by us in various localities.

Thorough spraying, as in the case of other species, is the only method of controlling this insect, and when applications are necessary they should be timely so that the insects can not curl leaves and thus obtain shelter from the spray.

Cabbage aphid (*Aphis brassicae* Linn.). This species is usually present in small numbers on various cruciferous plants, and only occasionally does it attract much attention on account of its abnormal abundance and consequent injury. Mr J. F. Rose of South Byron states that about the middle of August it was so abundant on early cabbages as to give them a white appearance, and Mr George S. Graves of Newport, Herkimer co., reports it as being numerous on turnips in early August. This species was observed by us in very large numbers on rape at Kinderhook the early part of the season. The insects were so abundant as to

give a whitish color to portions of the plant and rendered walking through the field extremely disagreeable.

Chaitophorus aceris. The Norway maple has enjoyed up to recent years comparative immunity from insect pests, and it was therefore a serious disappointment to its admirers when this species of plant louse injured it so seriously in the last two or three years. The damage by this species has gradually increased, and whereas in 1900 or thereabouts many of the trees had their foliage somewhat disfigured by the sooty fungus growing in the honeydew and drops of this sticky substance occasionally fell on passersby or moistened the sidewalk beneath, in 1903 some of these unfortunate trees had their foliage almost ruined by this pest. Many of the leaves were so badly curled that they presented only about one fourth of the usual surface, and this maple instead of being an object of beauty, was a monument of misery and an eyesore on the landscape. This was true not only about Albany but in various sections of the State. This plant louse can be controlled by thoroughly spraying with a contact insecticide, such as whale oil soap, taking special pains to hit the insects on the undersurface of the leaves, and it looks as though some such treatment would have to be adopted in coming years if we are to keep this shade tree in good condition. This species was the cause of more complaint and incidentally gave more employment to parties operating a spraying outfit in Troy, than even the notorious elm leaf beetle (*Galerucella luteola* Müll.).

Elm aphid (*Callipterus ulmifolii* Mon.). This delicate species occurs somewhat generally on our American elms, and occasionally becomes exceedingly injurious, as was demonstrated in 1897 and again in 1903. This little plant louse was so abundant on many trees during the past summer that the foliage became badly smeared by the honeydew, lost its color and all but failed to perform its proper functions. This condition was somewhat general in the vicinity of Albany, at Palatine Bridge in the Mohawk valley, and a similar state of affairs was reported from Ogdensburg, St Lawrence co. The most of the

damage appears to be inflicted in the latter part of June and during July.

Drepanosiphum acerifolii Thos. This delicate and really beautiful species when examined under a magnifying glass, is capable of causing considerable injury to various species of maple. Its work on hard maple was observed by us last July at Nassau, where it evidently caused considerable dropping of the foliage, and the young were to be found here and there along the veins on the underside of the leaves. Nearly full grown specimens are remarkable for being incrustated with a whitish secretion which nearly covers them. This species was met with by us in considerable numbers on maples at Saratoga, where it has likewise caused some dropping of the leaves and injured the foliage to a considerable extent. It was also reported by Mr George S. Graves, as being on several varieties of maple at Newport, Herkimer co., where it caused much dropping of foliage, and it was observed by Mr Young in small numbers at Poughkeepsie.

Box elder plant louse (*Chaitophorus negundinis* Thos.). A number of specimens of what we believe to be this species, was submitted for examination by Mr George S. Graves of Newport, Herkimer co., who stated that it was exceedingly abundant and destructive to box elder or ash-leaved maples in that vicinity. The attack was first observed in early June and continued till September, possibly later. It is probably the same species which we observed at work in large numbers the latter part of September on some box eldertrees at Nassau.

Beechtree blight (*Pemphigus imbricator* Fitch). This plant louse was exceedingly abundant on some beechtrees at Newport N. Y. Our correspondent, Mr George S. Graves, sent examples under date of Oct. 29, and from the appearance of the twigs we judge that the insect was present in enormous numbers, and had the attack been earlier in the season, it would undoubtedly have caused considerable injury. Mr Graves observed the habit of this species of clustering on the underside of the twigs, and adds that moderately cold weather does not seem to affect them, since an inch of snow was seen on the hillside

only a short distance away, and the temperature during the preceding two days had been quite cold.

Wooly beech aphid (*Phyllaphis fagi* Linn.). This insect has been unusually numerous on purple beech foliage in Washington park, where it was found in very large numbers, July 4. Its depredations on the same tree in Westchester county have also been brought to our attention.

Birch aphid (*Callipterus betulaecolens* Mon.). This little species is particularly injurious to the cut-leaved birch, and is occasionally very abundant. It was reported as being quite destructive at Newport, Herkimer co., by Mr George S. Graves, and evidences of its work were found by Mr Young at Poughkeepsie in the middle of July. The latter trees showed very plainly that the insect had been exceedingly abundant, since the foliage was badly discolored and well smeared with honeydew. We also observed the work of this insect in the vicinity of Albany, and specimens of very badly infested twigs were submitted for examination by Mr E. P. Van Ness of East Greenbush. In this instance, as in the preceding, the attack was a very severe one and the tree had undoubtedly suffered greatly throughout July, if not earlier in the season. Some of the leaves bore a number of pupae of the two spotted ladybug, *Adalia bipunctata* Linn., which had evidently fed on the plant lice, and reduced their numbers very largely.

Pemphigus popularius Fitch. This species is rarely brought to notice, though a few infested leaves of the balm of Gilead, *Populus balsamiferus*, were received from Lake Clear Junction through Mr C. R. Pettis. The leaves were drawn together and had much waxy matter on their surfaces, giving them the appearance of having been coated with a whitish powder. In some instances the insects formed a series of pseudogalls on the upper side of the leaves. The cavity produced by drawing the leaf together contained numerous winged plant lice, a few nymphs and many cast skins. Mr Pettis states that all the trees in the vicinity were affected by this species. Another poplar-infesting species, *Chaitophorus populicola* Thos., was met with in considerable numbers on the common aspen at Karner, July 24.

Fruit tree insects

Plum curculio (*Conotrachelus nenuphar* Herbst). This little enemy of stone fruits is prevalent to a greater or less extent in most orchards of this State, and occasionally causes considerable injury. It is remarkable for existing in some localities in such small numbers as to cause practically no damage, while in others a large proportion of the crop would be ruined unless collecting or other repressive measures were employed. Recent experiences by several growers in the State, go far toward showing that thorough and early spraying of the foliage with an arsenical poison affords considerable protection from this pest. This method is preferred by many to the more laborious one of collecting the beetles and is certainly worthy of further trial.

Diplotaxis liberta Germ. This species is rarely brought to notice on account of its depredations and the same is true of its allies. A complaint was received Sep. 24 through the commissioner of agriculture from Mr John R. Crandall of Hauppauge, who stated that this beetle had stripped all the foliage from many young peachtrees in an orchard of about 30 acres. He added that they worked at night, burying themselves in the dirt under the trees during the day, and that anywhere from 10 to 50 were found under each tree, apparently preferring Elbertas. The beetles occurred nowhere except in the peach orchard. This insect is closely related to our common May or June beetles and presumably has similar habits, the larvae probably living on grass roots and undoubtedly thriving best in light, sandy soils. Reference to literature shows that another species, *D. frondicola* Blanch., was recorded in 1871¹ as being very injurious in June to leaves of rose, mountain ash and wild plum in an Iowa nursery. They were about nearly a month, feeding only at night, and were considered one of the worst pests of that year. An attack similar to the one we have recorded occurred in the spring of 1888,² at Herndon Va. in a young orchard which had been mostly planted the preceding year. The 12-spotted *Diabrotica*, *Diabrotica 12-punctata*, was the principal depredator, though a species

¹Kridelbaugh. Ia. State Hort. Soc. Rep't 1871. 1872. p.161.

²Riley-Howard. Insect Life, 1:59.

of *Diplotaxis* was also present in small numbers. The plums and apricots near an old melon patch where the *Diabrotica* had bred were soon stripped of foliage and the insects spread over nearly the entire orchard. Another species of the same genus, *D. harperi* Blanch., was reported May 24, 1894,¹ as injuring strawberry plants at Campbellsburg Ind. The account states that they attacked the smaller and weaker plants on a $2\frac{1}{2}$ acre field and very quickly destroyed them. As many as 20 beetles or over were found at a time on a single plant. The insects appeared first in some wheat and when that became too tough migrated to the recently set strawberry field. The soil was a light, clayey loam and paris green was applied but without benefit.

These little scarabaeids are difficult insects to control and in a general way may be classed in this respect with the closely related and well known May or June beetles, *Lachnosterna*, and rose beetles, *Macrodactylus subspinosus* Fabr. Anything that tends to make the foliage distasteful to the insects, such as dusting with air-slacked lime, wood ashes, etc. has some protective value, but comparatively little benefit results from spraying with an arsenical poison. It is possible that collecting the insects by jarring into a curculio catcher might prove of some value. This would have to be done in the evening when the beetles are on the trees, and in all probability it would require considerable shaking to dislodge them. The injury to the foliage late in the fall is of comparatively little importance compared with depredations in the spring, and apparently there is a prospect of this species causing some injury at that time, in which event it would pay to go to considerable expense in collecting the beetles or employing some other means to destroy them, so as to prevent severe injury to the trees by the destruction of fruit and leaf buds early in the season.

Appletree tent caterpillar (*Malacosoma americana* Fabr.). This insect is more or less injurious each year, and during the present season has not been very destructive, though somewhat abundant in various localities, specially where no effort has been made to control it. The injury, as a rule, has been less than

¹Davis. Insect Life, 7:199

in the last two or three years, except in Cattaraugus county, where this species is reported as having increased very largely in the last two or three years.

Codling moth (*Carpocapsa pomonella* Linn.). It is well known that the larvae of this insect pass the winter in considerable numbers under the sheltering bark of trees, and that they gnaw pupal cavities in the outer dead bark. Our attention was recently called to a somewhat anomalous situation and an examination showed that a small tree had been badly injured by borers in preceding years and that codling moth larvae, descending the tree in the fall, had entered the galleries made by the borers and in excavating pupal cavities had not refrained from eating into living tissue where they caused considerable bleeding and at first sight lead one to suspect that the injury was due to the round-headed borer. The tree in question has a trunk about 6 inches in diameter and some 12 or 15 larvae were taken from several of the cavities. Three or four of the caterpillars were found contiguous to living tissue which had been recently eaten and from which considerable sap was flowing. The borings were conspicuous and many of the pellets were saturated with exuding sap.

Pear Psylla (*Psylla pyricola* Forst.). The season of 1903 has been remarkable for the unusual development of plant lice, and this little jumping species is no exception to the general rule. It has been exceedingly abundant and destructive over a considerable portion of the State, and peartrees with blackened, scanty foliage or almost none at all, were common sights during the summer not only in the Hudson river valley but also in central and western New-York. The injury was much more general and severe than has been observed before, and the explanation therefor is probably found in the unusually favorable climatic conditions. Evidences of great damage began to appear in June, and during July and August the affected trees presented a truly wretched sight. In some cases the injury was so severe that most of the fruit dropped. Mr H. D. Lewis of Annandale reports the crop of that section a failure, due to the work of this pest.

Early and thorough spraying with a whale oil soap solution, 1 pound to 4 gallons, has been found thoroughly effective in the hands of Mr Albert Wood of Carleton Station, who states that he has succeeded in keeping the insect well in subjection by this means. Thorough work in the early part of the season will do much toward preventing subsequent injuries, and if the necessity arises of repeating applications, much better results will be obtained if the work is done just after a rain, which serves the useful purpose of washing away the honeydew and therefore exposing the growing insects to the deleterious action of the insecticide.

San José scale (*Aspidiotus perniciosus* Comst.). This pernicious insect has become so abundant in some orchards in the State that its control is a serious problem, and anything bearing on its habits and disseminative powers is of interest. The latter part of the summer was marked by the development of very large numbers of insects, the breeding being so rapid that in some places the bark of entire trees was covered.

The rapidity of its spread in a locality is of great importance, and is undoubtedly influenced by a number of factors. In the first place, there is no doubt that the spread is much more rapid where the pest is allowed to breed unrestricted than in localities where such is not the case; for example, the scale has been in the large orchard of Mr W. H. Hart of Poughkeepsie for 13 years, and yet it has failed to spread to any great extent, portions being practically free from it even after the lapse of years. A close examination of the center of infestation existing at Clinton Heights shows that while the insect has been present there for about the same time there has been no extensive spread. The primary point of infestation is a little to one side of the center of an isosceles triangle, which has an altitude of $\frac{3}{4}$ mile. This is bordered on one side by a public highway and on the other by a trolley line. Several contiguous orchards lie within this area, and the pest has gradually made its way from one to the other, though the spread has by no means been rapid. Aside from the point of original infestation, the injury to the trees has not been very marked, in fact, the spread through these small orchards

has been so slow that those in the point of the triangle, less than half a mile from the original infestation, are still free from the pest. An examination of orchards just across the highway from near this center, failed to reveal any scale. It should be stated in explanation, that while the insect was allowed to breed in considerable numbers from about 1897 to 1899, since then earnest efforts have been made to keep it in check, and as a general thing, it has been controlled in a fairly satisfactory manner. It is true that there is one point of infestation a half mile southwest of the source of trouble, but investigation shows that in all probability the scale became established there by being carried on infested trees which were set in that vicinity.

Investigations and inquiries in a peach-growing section, where the scale had become established in a few places 3 or 4 years ago, reveals the fact that the pest has already obtained a foothold in some orchards from $\frac{1}{2}$ mile to 2 miles or thereabouts from others, and in this instance we are inclined to believe that these colonies established at a distance are due to the fact that no very adequate control of the insect has been maintained. It may also possibly be explained in part by the fact that young scales are fully as likely to crawl on peach foliage as on that of other fruit trees, and it would therefore stand a better chance of being conveyed by insects or birds.

New York plum scale (*Eulecanium juglandis* Bouché). This species is well known as a very destructive form to plumtrees in western New York, where it has at times been exceedingly injurious. Our attention was called in August to a plumtree at Kinderhook N. Y., which had the undersides of its branches literally covered with full grown scale insects and a great many young were found beside the parents. The tree itself had suffered serious injury though there were no signs of any numbers of the pest on those adjacent. This insect, as is well known, can be readily controlled by spraying in the fall or early spring with a contact insecticide, such as kerosene emulsion or whale oil soap solution, and we see no reason why the lime-sulfur wash, if it is to be employed in the orchard, would not be as effica-

cious in killing this species as it is in the destruction of the San José scale.

Plum mite (*Phytoptus phlaeocoptes* Nal.). The presence of this little mite on plumbrees at Marlborough, was brought to our attention some years ago, and an examination the present season shows that it exists in the locality only in very small numbers, and as a consequence is hardly likely to become a pest of any importance. The owner has cut down the original tree and anticipates very little trouble in the future.

Grapevine pests

Grapevine sawfly (*Blennocampa pygmaea* Harr.). The larvae of this species were met with rather plentifully July 28 in the vineyard of Mr W. H. Van Benschoten, West Park N. Y. Tips of shoots, here and there, were partially defoliated, but in no instance was material injury caused. The larvae are usually rare in New York State vineyards, so far as our observations go, and in case of their appearing in very large numbers, they should be controlled by thorough spraying with an arsenical poison.

Steely flea beetle (*Haltica chalybea* Ill.). This pernicious Chrysomelid is well known to grape growers, and in some vineyards in the Chautauqua region it has caused considerable injury year after year; particularly is this the case with certain vineyards located well up on the hill and back from the lake. The greatest damage is done by the beetles feeding on the unfolding buds, and the best method of checking the injury is undoubtedly by very thorough spraying or even painting the unfolding foliage with a strong arsenical mixture, particularly paris green or london purple, because these substances act more quickly than does arsenate of lead.

Grapeberry moth (*Polychrosis botrana* Schiff.). This insect was not only destructive in Chautauqua county but developed in such large numbers in some Ohio vineyards as to destroy one third of the crop as reported by Mr T. S. Clymonts. Our experiments have shown that one thorough spraying with an arsenical poison, preferably arsenate of lead, just after blossom-

ing, will result in severely checking this pest [see New York State Museum Bulletin 72].

Garden insects

Asparagus beetle (*Crioceris asparagi* Linn.). The common asparagus beetle as recorded in our 15th report, page 540, has attained a wide distribution over the State, though our records limit it almost entirely to the lower Hudson and Mohawk river valleys and the western portion of the State in the vicinity of the lakes. We were therefore somewhat surprised to receive a communication from Mr C. L. Williams of Glens Falls, Warren co., accompanied by specimens, stating that this species had become well established in that vicinity and was known to occur in some numbers over an area several miles in extent. This is the northernmost locality known to us, for the species in New York.

Cabbage maggot (*Phorbia brassicae* Bouché). This little pest of the market gardener was unusually abundant and destructive this season. Its depredations on early cabbages attracted considerable attention in Genesee county, it was credited with having destroyed one fourth of the crop in St Lawrence county, and with working to some extent in Cattaraugus county and other sections of the State. The life history of this little pest may be summarized briefly as follows: the adult insects appear in the early spring, the precise time depending somewhat on climatic and other conditions. They are, however, usually abroad in time to deposit eggs around early set plants, finding some crevice in which they may creep and place their eggs close to the stem. These remain unhatched for a period variously stated as from 4 to 10 days when the young grubs issue, attack the surface of the root and rasp a burrow into its tissues. They destroy first the smaller rootlets and then begin operations on the main root. They are frequently found in slimy burrows just beneath the surface of the stem. There are usually so many maggots that all are unable to find retreats within the tissues, and consequently many of them lie near the surface, which is kept moist by the juices from the injured parts. The wilting of the plant is the most

characteristic indication of injury and on pulling it up, the remains of the roots and the whitish, slimy maggots are easily observed.

One of the best methods for protecting cabbage plants from this insect is to surround them with a tarred paper collar about $2\frac{1}{2}$ inches in diameter, which is so cut as to practically encircle the stem. These are readily adjusted about the plant, easily cut and form one of the most efficient methods of preventing the parent fly from depositing its eggs.

A carbolic soap emulsion composed of 1 pound of hard soap dissolved in a gallon of water, in which 1 pint of crude carbolic acid is then poured, emulsified and diluted with 30 parts of water, is very efficient in killing the maggots about infested plants. An application should be made shortly after the plants are set out, and repeated once a week or 10 days till after the middle of May. The standard kerosene emulsion diluted with 12 to 15 parts of water has also proved very successful. Either may be readily applied with a knapsack pump. It is possible to check the attack, where labor is cheap by removing the earth from the affected parts in the morning of a bright day and replacing it at night. The drying kills the maggots without injury to the plants. This is practised to some extent on Long Island, as stated by Mr F. A. Sirrine.

Onion maggot (*Phorbia ceparum* Meigen). This serious pest of market gardeners has, like its close ally, the cabbage maggot, been very injurious in portions of the State, particularly in St Lawrence county where it is credited with having destroyed one fourth of the onion crop. It has also caused considerable complaint in the vicinity of Albany.

This insect, so far as known, has a life history very similar to that of the cabbage maggot, and may be controlled in like manner, except that it is impracticable to use the tarred paper collars though the carbolic soap wash can be employed to very good advantage.

Tarnished plant bug (*Lygus pratensis* Linn.). This notorious and almost ubiquitous pest occurs on a great many

plants and causes more or less injury from year to year. Last July our attention was again called to it on account of its sucking the juices from tender aster shoots and thereby killing them. Mr Egbert Blauvelt of Coeyman, who made the complaint, states that the insects can be killed by thoroughly spraying with a whale oil soap solution, using 1 pound to 9 gallons of water. Clean culture, not only in the garden but in adjacent fields, will do considerable toward reducing the numbers of this pest.

Grain and house pests

Saw-toothed grain beetle (*Silvanus surinamensis* Linn.). This little grain beetle is a common species in prepared foods and various grains and though occasionally very abundant, it does not as a rule cause much annoyance in this country. This species was found last August literally overrunning a dwelling house in Albany. The beetles were so numerous that they made their way into everything and the housekeeper could sweep up nearly a pint almost every warm day. They were found in all parts of the dwelling, resting on ceilings, crawling on walls, under mats, tablecloths etc. and even invaded wearing apparel, articles of food, etc. Investigation showed that the source of the trouble was several thousand bushels of oats in the bin of a near-by brewery. The insects were breeding there very rapidly and on warm days appeared in large numbers and invaded near-by dwellings. The best remedy for such an outbreak is fumigation of the grain with carbon bisulfid and similar treatment of the dwelling houses or better still fumigating them with hydrocyanic acid gas. This latter, however, is a very dangerous poison and must be handled with extreme care.

Fleas. The cat and dog flea (*Ceratopsyllus serraticeps* Gerv.) is a well known pest of domestic animals, and in the public mind is associated only with these animals. There are a number of records of this species propagating to a marvelous extent in houses closed for the summer, and the occupants on opening them in the fall would find their premises literally overrun by these annoying, active and most hardy pests. This has

been the experience of several Albanians in the past summer, and the most practical way of ridding the house of these vermin is by thorough fumigation with hydrocyanic acid gas, using 1 fluid ounce of sulfuric acid diluted with 2 fluid ounces of water and 1 ounce of high grade (98%) cyanid of potassium for every 100 cubic feet of space. A preliminary fumigation using half the above amounts and continuing the treatment two hours killed practically all the Psocids in the house and many fleas, while the usual amounts with a six hour fumigation destroyed all the fleas. The acid and cyanid are among our most deadly and virulent poisons and the same is true of the generated gas. Before treating, the house should be first carefully examined and every orifice or crack which would allow the egress of air should be carefully stopped. All fluids and liquid foods should be removed from the house and arrangements made so that the building can be opened from the outside after fumigation. The gas is generated by dropping the cyanid in large earthenware vessels containing the proper amount of diluted acid. It will be found advisable to have one or two of these jars in each room or hallway, and so arrange matters that the cyanid while still in the bag, can be dropped into one vessel after the other very rapidly, or else with a series of strings, dropped into all of the vessels at once. After the charge is set off the house should be carefully guarded so that no person can enter, and if it be in contact with others in a row, those in adjacent dwellings should also be warned so that the rooms next the treated building may be well aired during the fumigation, which should last from one to several hours. The building should then be thoroughly aired by opening doors and windows from the outside, and utmost pains taken to free the house of gas before any one be allowed to enter. The airing should last at least 30 minutes, and it will be preferable to extend this time to one, two or even three hours, dependent somewhat on the size of the building and the facilities for ventilation. One treatment should be sufficient but in the case of poorly constructed houses a second fumigation may be necessary a week or 10 days later. This dangerous operation should

be attempted only by those fully conversant with the nature of the materials with which they are dealing.

Shade tree and forest insects

Elm leaf beetle (*Galerucella luteola* Müll.). This species has won for itself a very bad reputation in the Hudson river valley on account of its extensive injuries to elms, particularly the European species. It is still extending the area of its operation. Last year it was detected in a limited portion of Saratoga Springs, and this season we were sorry to observe that it had spread over practically the entire village and would have caused material injury to the shade trees had it not been for the systematic and continued spraying conducted by the village authorities. An examination July 16 showed that the grubs were full grown in that locality and that many had pupated. We are inclined to believe that the second brood, if any, would be very limited in that section. This species has also been reported as present in very large numbers at Schuylerville, only a short distance from Saratoga Springs. It has become established over a considerable portion of Schenectady, where it is causing considerable injury and is likely to inflict more in the next year or two unless adequate measures are taken for its suppression. This insect as noted in Museum bulletin 64, has obtained a foothold at Ithaca N. Y. and we are in hopes that it will not be allowed to inflict serious injury on the beautiful trees of that city as it has on those of some others in the State. A detailed account of this species appears in Museum bulletin 57.

White marked tussock moth (*Notolophus leucostigma* Abb. & Sm.). This common enemy of shade trees annually attracts more or less attention on account of its ravages in different cities of the State, in spite of the fact that it is a comparatively easy one to control, not only on account of its eggs being deposited in conspicuous masses which may readily be removed from trees, but also because it is easily destroyed with arsenical poisons. In our preceding report we chronicled the abundance of this insect in Buffalo, and the present season has

been marked by a repetition of the injury, though the attack was not so severe as that of the preceding summer. The causes for this latter condition may be in part due to repressive measures adopted by citizens of that city, but on the whole we are inclined to believe that natural enemies or unfavorable climatic conditions were the most potent factors in reducing the numbers of this pest. The condition of the trees in that city is a most effective argument in favor of establishing a paid forester or other official whose duty it shall be to look after the street trees as well as those in the parks and see that they are adequately protected from insect ravages. This matter is one of increasing importance, as our cities are growing rapidly in size, and as a consequence there is a greater massing of foliage and therefore more favorable conditions for the development of large numbers of a species. It requires but a few years for insects to destroy a tree which may have been from 10 to 50 or more years in growing, and in cities where this is allowed a deterioration of real estate values must follow, accompanied by an increase of various diseases and a higher mortality, because of the rapid and extreme temperature changes due to the absence of trees.

This pest can be easily controlled in either one of two ways. Many of the caterpillars can be jarred or brushed from the infested trees, and their ascent prevented by the use of a band of loose cotton tied around the tree or a band of tar on a piece of stout paper, the latter to prevent injury to the tree. Both of these materials are very effective, and in our judgment vastly superior to the brass bands seen on the trunks of so many shade trees in Buffalo. Bands, however, are of value only in keeping the caterpillars off the trees. The jarring of the pests is somewhat laborious, and as the insects are readily destroyed by spraying with an arsenical poison a prompt application of some such material to the foliage is advisable. Arsenate of lead is one of the best poisons. It may be applied at the rate of 4 pounds to 50 gallons of water. Use this insecticide only in the prepared paste form, diluting to the proper extent, and under no conditions purchase the crystalline article. The older standard

poisons, paris green, london purple and similar preparations are very effective, though subject to washing by rains. These latter substances should be used at the rate of 1 pound to 100 gallons of water, with 1 pound of recently slaked lime to protect the foliage from burning. Spray thoroughly in any event and aim to cover so far as possible every leaf with the poison. Protective measures should be adopted early or the injury will be beyond repair. It is hardly necessary to add that it is impossible to grow magnificent trees if they are defoliated year after year, as unhappily seems to be the case in some cities in recent years.

Fall webworm (*Hyphantria textor* Harr.). This species appeared rather early in the season on various forest and fruit trees in different sections of the State, and in certain localities was somewhat abundant and destructive. Generally speaking it has not caused serious injury except in a few localities where no effort was made to check it. This species, like the two tent caterpillars, is readily controlled by spraying with an arsenical poison, and its conspicuous web nests, which serve as a retreat for the caterpillars, are easily removed from the tree and the inmates destroyed by crushing or burning.

Forest tent caterpillar (*Malacosoma disstria* Hübn.). As noted in our preceding report, Museum bulletin 64, page 104, the ravages of this pest are on the decrease, and the present season has witnessed practically no injury by this insect. A few caterpillars were observed in Rensselaer and Columbia counties but in no instance coming to our notice was a tree even partially defoliated. A lack of reports from other sections of the State indicates a like gratifying condition, and we are in hopes that this outbreak is practically ended and that the species will be comparatively innocuous for a number of years.

Walnut worm (*Datana integerrima* Grote & Rob.). The work of this insect is more or less evident each year, particularly in the western part of the State, and during the past summer our attention has been called to its ravages in Herkimer county, and we have observed a number of black walnut trees in Chautauqua county which have been from one half to two thirds or entirely defoliated by this caterpillar.

Beneficial insects

Chinese lady beetles (*Chilocorus similis* Rossi). The specimens obtained from the United States Department of Agriculture through the kindness of Dr L. O. Howard, and liberated in East Greenbush in August 1902 failed to survive the winter. A second shipment of 25 was received Aug. 13, 1903, again through the generosity of Dr Howard. These specimens were set at liberty at Kinderhook N. Y. on the estate of Mr L. L. Morrell, who is a large fruit grower. The tree selected was a large appletree badly infested with San José scale, near the barn and on the edge of the old orchard, close to his young pear orchard. There is an abundance of scale on the old trees, as well as on the young, and Mr Morrell has consented to refrain from treating these, in order to give the imported beetles an opportunity to demonstrate their value.

An examination Sep. 23, 1903, of the appletree where these insects were placed last August showed that eggs had been laid and a number of young were easily found. Four adult beetles, probably descendants of those originally established and nearly 20 larvae of varying size, from very young to nearly full grown, were found in the center of the tree. This is a quite large one and is very badly infested with the scale and there is every probability that there are many more ladybugs on it and near-by trees than were discovered, though a brief search failed to reveal any on the latter. The examination was purposely limited because of the difficulty of detecting the insects and the danger of crushing them in crawling about on the limbs. It certainly looks as though this introduction had been fully as successful as that of the preceding year and it is most earnestly hoped that some will survive the winter, in which event we may be able to demonstrate the utility of this insect in our climate.

Little black lady beetle (*Pentilia misella* Lec.). This little lady beetle is usually found toward the end of the season in orchards infested with San José scale, and we have on several occasions recorded its presence in some numbers. Anything relating to the abundance and effectiveness of predaceous insects is of interest, and it is gratifying to state that in October we found this

little species, far more abundant than we had observed it before, in a badly infested peach orchard in Orange county. The little beetles were so numerous that 20 or 25 could easily be counted on a small portion of the trunk of a peachtree, and undoubtedly some of them bore from one to several hundred of these little lady beetles. They were crawling actively over the infested tree and evidently looking here and there for insects suitable for their needs. It is a source of regret to state that in spite of the great abundance of these little lady beetles, there appears to be no very material diminution in the numbers of the scale insects, which literally swarmed on many of the trees. The worse infested ones were more attractive to the lady beetles than the others. We have yet to meet evidence showing that this species is very efficient in reducing the numbers of this scale insect.

EXPERIMENTAL WORK AGAINST SAN JOSÉ SCALE INSECT

The control of this pernicious insect is a problem of considerable importance in localities where it has become established. This work was begun by us in 1900, primarily for the purpose of testing the effectiveness and possibilities of crude oil applications. Our results show that a mechanical emulsion of this material can be used, and if great caution is exercised in its application, comparatively little or no injury follows. So many, however, have met with such ill success that we have also experimented to a considerable extent with other materials, specially since in the last year or two we have observed some evidences of injury to the bark after the application of oil. This first appears as an enlargement of the lenticels, which is evidently followed by a great increase in thickness and a very rough, unsatisfactory condition of the bark, and this has led us to question the advisability of continuing such applications year after year, and also to make further tests of materials which were free from this objection.

Early spring or winter applications

20% mechanical crude petroleum emulsion. The work with this insecticide was continued the present season in the experimental orchard, the application being made Mar. 3, to about 70 trees

representing a number of the more common varieties. - It will be observed that the spraying was earlier than usual, and the weather conditions favorable, the day being dry with only a moderate amount of wind. This insecticide was applied as in the spring of 1902, to the following trees: numbers 15-28, 34-47, 60-74, 79-91 and 101-14; or in other words, to the western end of the experimental orchard, a map of which was published in our report for 1900. The general character of the trees and their varieties have been previously published, and may be ascertained by referring to the above publication. Tests of the mechanical dilution were made while the work was in progress with the following results: at tree 18 slightly less than 20%; at tree 39, 26%; at trees 45 and 46, 31%; at tree 84 slightly less than 20%, and at tree 101, 33% of oil. The above figures represent more variation than is desirable, and yet, so far as we were able to see, the trees suffered very little from the treatment. Inspection a few days after showed that all were well covered with oil, though in some cases where the bark was quite rough, it is probable that there were scales which escaped.

Examination of these trees the latter part of July showed that while a number of them were rather badly infested by living young, a great many were relatively free. The following were rather badly infested: trees 15, 16, 22, 38, 41-44, 73, 79, 82 and 86. The foliage on tree 101 was light in color, small in size and the growth only fair. It looked as though it had suffered some injury, and undoubtedly the petroleum had hurt the bark to some extent. This injury was also noticeable to a lesser extent on some other trees, the most common indication being much enlarged lenticels, which seemed to be followed by an excessive development of outer bark and a corresponding roughness, so that trees in this condition presented a somewhat bad appearance.

A general examination of the experimental orchard Sep. 25, showed that the section sprayed with petroleum emulsion was generally in much better condition than that treated with the lime-sulfur wash. A few of the trees in the petroleum section, notably 23, 41 and 75, were badly infested by numerous living

young which had evidently developed within the last two or three weeks.

The ultimate effect of successive applications of crude petroleum to various fruit trees is of some interest, and on this account we purposely made annual applications to certain trees, and an examination of them is not without interest, since while it shows some injury, the damage is not so serious as it first appeared. For example, tree 101, a seckel pear, was very badly infested in 1900, when it was sprayed with undiluted petroleum and seriously injured. The following year it was treated with a mechanical mixture consisting of 15% oil and a whale oil soap solution, 1 pound to 4 gallons, and in the spring of 1902 and of 1903, with 20% mechanical emulsion. The tree at the outset, as above noted, was in poor condition. It has been steadily improving, and last December had developed a large amount of new wood, and during the present season has made a fair growth, though the foliage is rather light in color and less than normal size. Tree 114, a pear of the same variety, received undiluted crude petroleum in 1900, but was not injured so seriously as 101. Each subsequent year it has been sprayed with a mechanical crude petroleum emulsion and is now in a vigorous condition and in much better state than three years ago, though the roughness of the bark on the trunk is becoming more pronounced. Tree 69, a Howell pear, was sprayed in 1900 with the whale oil soap and petroleum combination, and with mechanical petroleum emulsions the three succeeding springs, and is now in as good condition as others which have not been subjected to annual applications of oil. The same is practically true of tree 66, a Bartlett pear. Other instances might be cited, but enough has been given to show that ordinary fruit trees can stand at least four applications in successive years without much injury. The benefits resulting from this treatment in the vicinity of Albany, as compared with those accruing from the lime-sulfur combinations, were so marked that the owner has repeatedly urged us to apply the oil to the entire orchard, because the lime-sulfur wash had not proved satisfactory in controlling the scale. It is only fair to add that much better results have

been obtained with this latter insectide in some other portions of the State.

Lime-sulfur washes. Early experiments with this material were so unfavorable, that it was supposed to have no value in our eastern climate, though it had been used with great success in California. The matter was revived in later years, and recent tests have shown that under certain conditions, at least, very large proportions of the scale have been killed by the use of this insecticide. Our applications last year were somewhat unfortunate, in view of the fact that we failed to kill a satisfactory proportion of the insects, and in this respect our results were somewhat different from those obtained by other experimenters. The treatment was followed by continued heavy rains, and this, with oil from applications the preceding year may account for the noneffectiveness of the wash. Further experiments were conducted the present season for the purpose of testing the value of the preparation more thoroughly, and also for determining, if possible, the best wash to be employed. The early spring experiments were at Clinton Heights, and at Warwick. Two formulas, in particular, were tested: one which may be known as the 30-30-30 combination to 100 gallons, and the other the 40-15-20 to 60 gallons. Both gave excellent results at Warwick, where conditions were almost ideal for careful experimentation, and a modification possessing some advantages was also employed. This latter consists of 25 pounds of lime, 20 pounds of sulfur to 60 gallons of water. Unfortunately the experiments at Clinton Heights though carefully performed failed to yield the results we desired, partly on account of unfavorable conditions due to very large trees with rough bark being the only ones available. In our experimental orchard at Clinton Heights an application of lime-sulfur, using a 30-30-30 formula, was made to the same trees treated in this way the preceding year, and we regret to state that the results were not very satisfactory, though the application was more successful than that of 1902. The spraying was followed immediately by some snow and rain, and while this may have had a detrimental effect, it does not account entirely for the failure. It is possible that the extremely

rough bark on certain trees sheltered some of the scale insects from the application, and consequently it was only a short time before the trees were restocked by breeding. An interesting series of experiments was conducted at Warwick, the essential details of which are given in the table on page 156. Owing to difficulties in application etc., it was not always possible to regulate closely the period of boiling, and while our intention was to rigidly test the long and the short boil in each formula, as a matter of fact there was some variation as will be seen on consulting the table. The destruction of the scale, however, was all that could be expected, and it is very gratifying to state that Mr W. H. Hart of Poughkeepsie, whose large orchard is infested with this pest, was able by the use of a wash composed of 30 pounds of lime, 20 pounds of sulfur and 15 pounds of salt to 60 gallons of water to keep the insects in subjection in a very satisfactory manner indeed, though some of his trees were of considerable size, being 18 to 20 or more feet high. Mr Hart was careful to have the application made in the most thorough manner and he took pains to always work with the wind when spraying, and in this manner was able to obtain a maximum efficiency with a minimum amount of labor. Comparisons on trees which were sprayed on only one side gave most gratifying testimony to the efficacy of the wash, the treated portions being practically free, while the untreated were almost covered with the pest. Ben Davis seems to be much more susceptible to the scale than the Thompkins County King. Mr Hart is of the opinion that a small amount of rain, particularly a mist for a day or two immediately after spraying, is of value because it brings the caustic wash into more intimate contact with the scale. Mr L. L. Morrell of Kinderhook has also had excellent results from use of a lime-sulfur wash and the same is true of Edward Van Alstyne of the same place.

It is undoubtedly true that considerable variation is allowable without materially influencing the value of the application. A large amount of lime probably has some value because it forms a thicker coat over the branches and is therefore a more efficient mechanical barrier in preventing the establishment of young scale

Warwick experiment, applied March 25-27

Wash	COMPOSITION AND PREPARATION							PROPERTIES				Weather
	Lime	Salt	Sulfur	Resin	Copper sulfate	Water	Boil	Color	Sediment	Adhesiveness	Results	
1	30 lb	30 lb	30 lb	0	0	100 gal.	1½ hr	Dark amber	Very little	Good	Very effective, checking breeding	Cloudy with strong wind Fair, few days following
2	30 lb	0	30 lb	0	3	100 gal.	1 hr	Dark amber, bluish tinge	Very little	Good	most entirely and probably killing most of the females	
3	30 lb	0	30 lb	0	0	100 gal.	1½ hr	Dark amber	Very little	Good		
4	30 lb	0	30 lb	0	0	100 gal.	½ hr	Light orange	Little	Fair		
5	30 lb	0	30 lb	12 lb	0	100 gal.	45 min.	Dark amber	Some	Very good		
6	40 lb	15 lb	20 lb	0	0	60 gal.	1 hr	Amber	Little	Good		
7	40 lb	15 lb	20 lb	0	0	60 gal.	35 min.	Amber	Little	Good		
8	40 lb	0	20 lb	0	0	60 gal.	1 hr	Amber	Little	Good		
9	40 lb	0	20 lb	0	0	60 gal.	½ hr	Amber	Little	Good		
10	40 lb	0	20 lb	8 lb	0	60 gal.	40 min.	Amber	Much	Good		
11	25 lb	0	20 lb	0	0	60 gal.	2 hr	Amber, greenish tinge	Some	Good		
12	25 lb	0	20 lb.	8 lb	0	60 gal.	1 hr	Amber	Much	Fair		

insects. If too much lime is used it is liable to scale off; consequently there is a limit to the amount which can be employed, and for various practical reasons we are inclined to believe that 25 pounds of lime, 20 pounds of sulfur to 60 gallons of water is a very good proportion. The lime probably aids materially in holding the sulfur and its sulfids (which latter are undoubtedly among the most valuable constituents of the wash), and thus adds to the efficiency of the insecticide by preventing to some extent leaching of its active ingredients. Our experiments fail to indicate the necessity of prolonged boiling insisted on in so many formulas. In fact, it seems as though active boiling for 30 minutes meets every requirement. A wash prepared in this manner appears to be just as effective as one which has been boiled for a much longer time. Salt increases the specific gravity of the liquid and thus undoubtedly aids in keeping the solids in suspension, but so far as chemical action and insecticidal properties are concerned, it appears to have no value, and the same is true of its effect on the adhesive qualities of the wash. So marked is this that we have omitted it from the composition of the wash because of its very problematic value. We are still of the opinion that climatic conditions have considerable influence on the effectiveness of this insecticide, and believe that it should be applied when the trees are dry or nearly so, and that, in order to obtain satisfactory results, no large amount of rain should fall within three or four days after the spraying. This insecticide gives very good results wherever it can be applied thoroughly and has the advantage of being cheaper than any other winter wash, though it is decidedly more injurious to apparatus and exceedingly disagreeable to apply.

The resin solution [see p. 160 for preparation] was added to several of the washes in hopes that it would materially increase their adhesiveness and likewise their insecticidal properties, because such seemed to be the case in some preliminary indoor experiments. Field tests, however, failed to indicate any great advantage resulting from the addition of this material, except perhaps in the case of rains immediately following the applica-

tion. It affected the washes by making them more or less flaky, increasing the amount of sediment, and if much more had been added it would probably have seriously affected the operation of the pump. This material, if used, must be thoroughly diluted with warm water before being added to a cooler lime-sulfur wash, or it is likely to give trouble by gumming up the apparatus.

Summary. Our experience and experimental work may be summarized briefly, as follows:

A mechanical 20% crude petroleum emulsion is a very effective insecticide, and if the pump can be relied on to deliver a constant proportion, there is very little danger of much injury from several annual early spring applications. There is, however, some doubt as to the ultimate result, and the continued use of this material causes increased thickness and roughness of the bark, if no other injury.

Early spring applications of whale oil soap solution, even if only $1\frac{1}{4}$ pounds be used to a gallon, will control the insect in a very satisfactory manner, provided the spraying is thorough. We are by no means certain that this can be done on large trees, particularly those with rough bark.

The lime-sulfur combination is steadily gaining favor in the eastern states, and under certain conditions, at least, is fully as effective in checking the scale as either crude petroleum or a whale oil soap solution. Our experiments lead us to believe that 25 pounds of lime and 20 pounds of sulfur to 60 gallons of water, are equally as effective as larger amounts, and we believe it to be an advantage to have a little more lime than sulfur. We fail to see any beneficial results from the use of salt in this combination, and therefore have omitted it; and in our experience, active boiling for 30 minutes, if the lime is slaked in hot water and the sulfur added at once, gives just as effective a wash as one which has been boiled for one and one half or two hours.

In conclusion, the experience of Mr Hart and other up to date fruit growers, has demonstrated not only the possibility but the practicability of keeping this insect in control in an ordinary commercial orchard. Our observations show beyond doubt, that

this scale insect is a very serious enemy, and unless efficient measures are promptly adopted for its suppression, very great injuries may be caused.

Summer washes

This pernicious insect breeds with such extraordinary rapidity during the summer, that ordinary applications of whale oil soap or kerosene emulsion are not entirely satisfactory, since at the strengths usually employed only the crawling young and smaller scale insects are killed. It frequently occurs that an infestation is discovered in midsummer and the owner wishes to do something at once. The unsatisfactory results with the above named washes led Mr P. L. Husted, nursery inspector of the Department of Agriculture, to experiment with a mechanical 20% crude petroleum emulsion, which was applied in July with a kerowater sprayer to peachtrees. A test of this material was made in a very badly infested orchard in the summer of 1902, and beyond causing some of the foliage to drop where it was the thickest, particularly in places where a 25% emulsion was used, as was the case in certain areas, no serious injury to the trees followed the treatment. The results were so satisfactory that the same course was pursued last summer with equally gratifying effect so far as injuring the trees was concerned, though at the time it did not appear as if the application was effective enough in killing the scale. Subsequent observations, however, have shown that it was more beneficial than at first supposed. In spite of this, we still feel some hesitancy in recommending this treatment in summer, except, perhaps, where the pest is breeding in very large numbers.

This condition of affairs led us to undertake a series of experiments for the purpose of ascertaining if it were possible to make some combination which, while not injuring the foliage, would remain on the trees and be effective for some weeks after application, and at least kill the crawling young as they came from under the protecting scales of the females. The late Professor Lowe conducted some experiments along this line, and our work has been a continuation of that with modifications. It appeared to us as though a lime-sulfur combination, possibly without boiling, could

be made of a proper strength so that it would kill a large proportion of the younger scales, and we were in hopes that it would be powerful enough to destroy individuals emerging from females several weeks after application. The basis of these experiments was a standard wash which we had used the preceding spring with very gratifying results on dormant fruit trees. This wash contained 25 pounds of lime, 20 pounds of sulfur to 60 gallons of water. It was diluted to various strengths, and an effort made to ascertain whether boiling for 15 or 30 minutes had any material effect on the efficiency of the wash. In addition, a resin solution was used, which is prepared as follows: dissolve 3 pounds of sal soda in 3 quarts of water and add thereto 4 pounds of resin and boil till dissolved. While hot, make up to 5 gallons and keep boiling till the resin is well in solution. The resin was added simply to increase the adhesiveness of the wash, in hopes that if this were done the efficiency of the combination would be materially increased. In a few instances the lime-sulfur combination was used with the bordeaux mixture for the purpose of testing the value of this combined wash. The preparation and application of the washes was the work of Assistant C. M. Walker, who is also responsible for many of the field observations. The following table gives in a summarized form the various ingredients of the different washes and their effects on trees and scale and also the conditions under which they are applied. These experiments were conducted in our experimental orchard at Clinton Heights near the western boundary of East Greenbush.

Table of summer washes

COMPOSITION AND PREPARATION			PROPERTIES					Weather						
Series	Wash	Lime	Sulfur	Resin	Salt	Water	Boil		Bor- deaux	Application	Tree	Adhesive- ness	Effect on foliage	Effect on scale
1	1	25 lb	20 lb	4 lb	0	240 gal.	0	0	After 2 hr stand	Young apple	Very poor	Uninjured	Kills crawling young only	Applied June 22, fair, with heavy showers on few following days
	2	"	"	"	15 lb	"	0	0	"	"	"	"	"	"
	3	"	"	4 lb	0	960 gal.	15 min.	0	"	"	"	"	"	"
	4	"	"	0	0	"	"	0	"	"	"	"	"	"
	5	"	"	0	0	"	30 min.	0	"	"	"	"	"	"
	6	0	0	0	0	0	0	50 gal.	"	"	Fair	"	"	"
	7	0	5	1	0	0	0	0	"	"	"	"	"	"
	8	5 lb	5 lb	0	0	0	15 min.	0	"	"	"	Good	"	"
	9	"	"	1	0	0	0	0	"	"	"	Fair	"	"
2	1	25 lb	20 lb	4 lb	0	60 gal.	0	0	After 2 hr stand	Young apple	Very poor	Uninjured	Kills crawling young only	Applied July 28, fair, with con- tinuous rains for a number of days following
	2	"	"	"	0	120 gal.	0	0	"	"	"	"	"	"
	3	"	"	"	0	60 gal.	15 min.	0	"	"	Very good	"	"	"
	4	"	"	"	0	120 gal.	"	0	"	"	"	"	"	"
	5	"	"	"	0	240 gal.	"	0	"	"	Very poor	"	"	"
	6	"	"	"	0	480 gal.	"	0	"	Peach	"	Slightly burned	"	"

Table of summer washes (continued)

		COMPOSITION AND PREPARATION								PROPERTIES				Weather
		Wash	Lime	Sulfur	Resin	Salt	Water	Boil	Bor-deaux	Application	Tree	Adhesive-ness	Effect on foliage		Effect on scale
3	1	25 lb	20 lb	4 lb	0	60 gal.	0	0	After 2 hr stand	Old apple	Very poor	Slightly burned	No scale present	Applied August 14, fair, and days immediately following. Rain Aug. 16-20
	2	"	"	"	0	120 gal.	0	0	"	"	"	"	"	
	3	"	"	"	0	60 gal.	15 min.	0	"	"	Very good	Badly burned, leaves off	"	
	4	"	"	"	0	120 gal.	"	0	"	"	"	Burned, leaves retained	"	
	5	"	"	"	0	240 gal.	"	0	"	Old apple	Very poor	Uninjured	"	
	6	"	"	"	0	480 gal.	"	0	"	Peach	"	Tips slightly burned	"	
4	1	25 lb	20 lb	4 lb	0	240 gal.	15 min.	0	Imme-diately	Pear	Very good	Slightly burned	75 % killed	Applied August 21, fair and im-mediate days
	2	"	"	"	0	"	30 min.	0	"	Peach	"	Slightly burned	15 % killed	
										Pear		Slightly burned	85 % killed	
										Peach		Slightly burned	40 % killed	

	25 lb	20 lb	4 lb	0	240 gal.	15 min.	0	Imme- diately After 2 hr stand	Old apple	Good	Slightly burned	85% killed crawling young only	Applied Sep. 4, fair, warm and 3 following days. Heavy rains in October
1	"	"	"	0	"	"	0	Imme- diately After 2 hr stand	"	"	"	No scale present	
2	"	"	"	0	"	"	0	Imme- diately After 2 hr stand	Pear	"	"	30% killed crawling young only	
3	"	"	"	0	"	30 min.	0	Imme- diately After 2 hr stand	Plum	Fair	Very slightly burned		
4	"	"	"	0	"	"	0	Imme- diately					
5	"	"	"	0	480 gal.	15 min.	0	Imme- diately					
6	"	"	"	0	"	30 min.	0	"	Pear	Very good	Uninjured		
									Peach		Tips slightly burned		

Series 1. Nine different washes were applied June 22 in this series, and observations made at intervals from June 26 to Sep. 28. Very small amounts were used and the solutions allowed to stand two hours. Different results might have been secured if larger quantities had been employed and applications made at once. The spraying was done with a fine hand atomizer and treatment limited to young, badly infested apple trees which bore all stages of the scale. These trees had been set out only a few weeks and consequently made little growth, though the foliage was in fair condition. The various washes did not injure the leaves, and it will be noted that washes 1 to 5, which were either unboiled or very dilute, adhered poorly, while 6, 7 and 9 containing bordeaux were better in this respect, and 8, which was boiled and also contained bordeaux, was much better. None could be distinguished on the tree 10 days after application. All washes killed the majority of the crawling young but did not prevent the development of established scales or the growth of young appearing after treatment. There was very little appreciable difference in the various washes, and on Sep. 8 all the trees were badly infested by all stages, crawling young being specially abundant.

Series 2. Six washes were applied July 28 in this series, and observations made from July 30 to Sep. 8. The washes were prepared in substantially the same manner as indicated above, and applied to the same lot of trees with the exception of a branch of a peach tree which was sprayed with 6. The condition of the foliage and scale infestation was identical with that in series 1, and the weather conditions were similar. Apple foliage was uninjured by any of the washes, but peach leaves were slightly burned at the tips by wash 6. Washes 3 and 4 were boiled 15 minutes, were more adhesive than the others, and Aug. 10 showed good color but on Sep. 8 no trace remained. The crawling young only were killed.

Series 3. Washes in this series were applied Aug. 14 and were similar to those of series 2. Observations were made from Aug. 17 to Sep. 8, and the conditions, preparation, etc., were practi-

cally the same as in series 1. The applications were confined to portions of old apple trees except in cases of washes 5 and 6, which were also applied to peach trees. The scale infestation was slight and the weather fair immediately following the treatment. Apple tree foliage was injured by wash 3, which caused the leaves to shrivel and fall off, and 4 burned them slightly. Wash 5 burned tips of peach leaves, and 6 had the same effect. Numbers 3 and 4 adhered very well for three weeks.

Series 4. The two washes used in this experiment were applied Aug. 21 and observations made from Aug. 27 to Oct. 20. Relatively large amounts were used and the applications made immediately after preparation. The cyclone nozzle used gave a somewhat coarser spray than the atomizer employed in the first three series. Pear, plum, peach and mulberry trees were used in this experiment and most of them were badly infested. The foliage was in good condition, the weather fair and remained so for a few days following the spraying. Plum and pear leaves were injured by wash 1, particularly in the case of a pear where the treatment was specially thorough. This latter dropped its leaves, while another, which received less of the mixture, did not, though the foliage was evidently injured. Wash 2 seriously injured peach leaves and caused slight burning of plum and mulberry foliage. Wash 1 adhered very well and was present in thick layers Sep. 8 and traces of color could be detected Oct. 20. The same was true to a lesser extent of wash 2. Oct. 20, number 1 had destroyed 75% of the scale on a pear tree, and the foliage was slightly burned. A number of limbs were dying on the tree, which had dropped its lower foliage and on which the scale was entirely dead. Only about 15% of the scale had been killed on the living branches. Wash 2 killed 40% of the scale on one tree and about 85% on the other, which latter was in very bad condition.

Series 5. Six washes were applied Sep. 4, and observations made at intervals from Sep. 6 to Oct. 20. Small amounts of the washes were used and the same nozzle was employed as in series 4. Apple foliage was slightly burned by washes 1, 2 and 3,

and pear leaves with wash 4. Plum foliage was injured very slightly by wash 5, and number 6 burned tips of peach leaves to a slight extent but did not injure pear foliage. Washes 1, 2, 3 and 4 adhered well, 5 and 6 more so, 6 in particular being thickly incrusting on limbs and foliage. Wash 1 killed 85% of the scale, and there was a marked contrast between sprayed and unsprayed branches. Wash 2 had no effect on the scale, while 4 killed 30%. The latter was boiled longer and this may account for its greater effectiveness. Variation in intervals between preparation and application appeared to have no effect on the adhesive or insecticidal qualities of these washes.

Summary. A mechanical 20% crude petroleum emulsion was applied in early July, two seasons in succession, to peachtrees without causing much injury beyond dropping some of the foliage where it was the thickest. It undoubtedly destroys a large amount of scale and seriously checks breeding, yet we hesitate to do more than state what it has accomplished. It is perhaps the best thing that can be used where a very bad infestation is discovered in midsummer.

A whale oil soap solution, 1 pound to 8 or 10 gallons; a kerosene emulsion (standard formula diluted with 6 to 10 parts of water), or a 15 or 20% mechanical kerosene emulsion can be used in midsummer for checking the San José scale, but none of these materials can be relied on to kill much more than the crawling young, and breeding is soon almost as bad as before the application unless treatments are frequent.

Our experiments with lime-sulfur combinations for a summer wash have not been as successful as was hoped, though 25 pounds of lime, 20 pounds of sulfur to 240 gallons of water with a 15 minute boil killed a large percentage of the scales on an old appletree in early September without materially injuring the foliage. It is barely possible that a combination of about this strength can be used with beneficial results, but nothing of the kind can be recommended till further experiments have tested its practicability.

DISEASED AND DYING TREES AND INSECT ATTACK

The connection existing between diseased and dying trees and insect depredations is not only one of interest, but also of considerable importance, since in some instances at least serious depredations have origin in a group of diseased or dying trees. It is well known for example that certain species exhibit a decided preference for trees in this condition, and when breeding therefrom in very large numbers are liable to attack healthy trees, if nothing more suitable is within reach. It is very likely for example that the more serious injuries by the elm borer, *Saperda tridentata* Oliv., and the elm snout beetles, *Magdalis armicollis* Say and *M. barbata* Say, begin in this manner. These three insects can at least complete their transformations in dead tissues and are known to work in those which are living, and it seems very likely that in some cases they first attack a sickly limb or tree, and then after becoming abundant are able to kill others which show no signs of lowered vitality. The same is true of certain bark borers belonging to the genus *Tomicus* which operate exclusively in coniferous trees. Our largest species known as the coarse-writing bark beetle, *Tomicus calligraphus* Germ., usually breeds abundantly in diseased bark and instances have come under our observation where this species not only ran a few galleries in living tissues, but evidently took part in a primary attack on a tree in apparently normal condition. It was assisted in this work by a smaller pine bark beetle, *Tomicus pini* Say, which operates in the thinner bark, about the middle portion of the trunk and on the larger limbs. This latter species very likely has more to do in killing trees than the form previously mentioned, but evidence at hand indicates that the larger as well as the smaller may have an important part in this destructive work when conditions are favorable. The destruction of trees by insects breeding from a few dying ones was well illustrated in the summers of 1900 and 1901, at which time a number of pines in the vicinity of Albany began to look unhealthy. Investigation showed that they were infested with bark borers, and later in the season

of 1900 and the following many of the borers emerged from these dying trees and entered others, in which latter they were presumably the prime cause of death. The evidence at hand leads us to believe that in this case the bark beetles were primarily attracted to certain trees because of reduced vitality, possibly as a result of the excessive drouth of the preceding year, and that all subsequent injuries were due to their abnormal abundance; since they issued from the infested trees in swarms and attacked those adjacent, and the insects breeding from the latter in turn invaded others more remote from the center of infestation. The obtaining of data along these lines is somewhat difficult, since it is dependent on favorable conditions, and the following account of observations made during the past season has an important bearing on one aspect of this subject.

Forest fires and insect attack. The annals of entomology contain very little regarding the relationship existing between forest fires and insect attack, and the extended burnings last spring in the Adirondacks, presented a most favorable opportunity for studying this question, so far as fires occurring at that time of year are concerned. The principal object was first to secure data on the rapidity with which insect injury followed fire, and second to learn if there was a connection between extended fires and serious damage by insects in adjacent forests. It is very probable that the time of year when the fire occurs, has considerable bearing on the liability of insects entering the trees and breeding in large numbers, and the same is true of the character of the fire. A forest fire which not only kills but burns trees so badly that there is a rapid drying of those standing is much less likely to be followed by insect attack than one where there is only sufficient burning at the base to kill, specially if death is not rapid. Ap. 30, May 15 and June 3 there were somewhat extensive fires in the vicinity of Big Moose, and investigations by assistant D. B. Young, July 2, showed that insect attacks had become nicely started in the burning of May 15, more advanced in that of April 30, while practically no signs of insect presence were observed in that of June 3. This would seem to indicate that the trees are not at-

tacked till from four to six weeks after the initial injury. Mr Young's investigations showed that trees entirely killed by the fire were less subject to attack than those which had been so severely scorched as to be nearly dead or in a dying condition. An examination July 3 of a large tract at Big Moose, which was burned over June 3 and was extinguished on the 18th, failed to show any insects working on these trees; in fact, within the fire zone they were scarce, only a few common moths and a lady beetle being observed; just outside this fire zone, where trees had been felled to keep the fire from spreading, a few spruce bark beetles, *Polygraphus rufipennis* Kirby had begun to attack the spruce. The trees were attacked in the following order: pine, spruce, tamarack, birch, hemlock, balsam, beech and maple.

Investigations by Mr Young on Aug. 12 of the area burned June 3 showed a remarkable scarcity of bark borers (scolytids) in the fire zone at Big Moose. This may possibly be explained by the fire occurring at a time when no brood of adults was able to take advantage of the favorable conditions, and it may also be that the injured trees were not attractive enough to the insects for some reason or other. In our own experience, we have come across several burnings where it would appear as though bark borers should be abundant, and yet examination has shown them to be present in very small numbers. The timber on the above mentioned area has been injured entirely by large buprestids mentioned in succeeding paragraphs, which cause comparatively little injury to the lumber. The section burned Ap. 30 was also examined, and the principal damage here had evidently been caused by the ambrosia beetles (mentioned in following paragraphs), since they operate in sapwood and produce the black pin holes which seriously affect the commercial value of lumber.

Pine. Investigations July 9 at Lake Clear Junction, where a fire occurred May 18, showed that the pine bark borer, *Tomicus pinii* Say, was working in the living tissues of a tree which had been injured by the fire.

The work of this species should be followed soon by that of the sawyer, *Monohammus confusor* Kirby, or *M. scutell-*

latus Say, which begins its operations by depositing eggs in large slits in the bark. The grubs tunnel the inner tissues of the bark and in the course of a short time enter the sapwood and by winter probably pierce the trunk to a considerable depth, materially injuring the lumber for other purposes than firewood. Mr Young's investigations in both July and August disclosed no signs of injury by this species. Two specimens of *Rhyncolus brunneus* Mann. were taken by him July 9 at Lake Clear Junction from a pine injured by fire the previous year.

Spruce. This tree was first attacked by the spruce bark beetle, *Polygraphus rufipennis* Kirby, and the lined ambrosia beetle, *Xyloterus lineatus* Kirby. The former is a very common insect in the Adirondacks and undoubtedly causes a large amount of injury by killing trees, while the latter, working as it does in the sapwood and producing conspicuous black holes, seriously affects the merchantable value of considerable lumber. July 3 almost every spruce in the area burned Ap. 30 at Big Moose was attacked by these two insects, the first working near the top of the tree, while the latter operated in the lower portions of the trunk. Another ambrosia beetle, *Gnathotricus materiarius* Fitch, was also observed in small numbers in the base of one or two trees. On another section, where the fire occurred May 14, it was found that the spruce bark beetle, *Polygraphus rufipennis* Kirby, and the lined ambrosia beetle, *Xyloterus lineatus* Kirby, had just begun work, and a species of *Chrysobothris* was also met with on spruce. Burned areas in the neighborhood of Lake Placid were also visited, and it was found that on the section where a very severe fire occurred April 30, the insects began operations later than on the area burned over about the same time at Big Moose, where the fire was not so injurious to the trees. The fire at Lake Placid, occurring June 3, was less injurious than the one at Big Moose on the same date, and on July 9 the scolytids were just beginning to attack the spruce, indicating that trees which were merely scorched, but not so much as to kill them at once, are sooner attacked by insects.

Investigations of spruce Aug. 12 on the tract at Big Moose which was burned June 3 showed that trees giving no evidence of insect attack on July 3 were infested with the larvae of a buprestid, probably *Chrysobothris scabripennis* Lap. & Gory. This record is of interest as showing when the trees are likely to be infested by this class of borers, which operate largely in the sapwood and do not seriously affect the value of the lumber. This beetle was fairly common on standing but badly burned spruce. The buprestid showed a decided preference for larger trees, though those which were badly scorched so that the inner bark had dried were not infested. Two or three specimens of *Xylotrechus undulatus* Say were taken on spruce, and *Phymatodes dimidiatus* Kirby was also met with in sparing numbers. The bark borers noticed above had made considerable progress.

Tamarack. Investigations July 9 of a section burned May 14 at Lake Clear Junction resulted in finding a tamarack infested by a scolytid, possibly *Tomicus pini* Say. A specimen of *Lepura*, *L. subhamata* Rand., was also taken from a burned trunk.

Birch. The yellow birches at Big Moose on the tract burned over Ap. 30 were in early July, in many cases, slightly green at the top and were being mined by *Dryocoetes eichhoffi* Hopk.; specially was this the case where the trunks were scorched seriously enough to interfere with the circulation of sap. The common flat-headed borer, *Chrysobothris femorata* Fabr., was taken on a fallen birch. The pigeon tremex, *T. columba* Linn., was observed in small numbers on birch, but investigations showed that its attack was confined to more or less decayed trees. This insect was also met with under the same conditions on maple and beech trees. Birch trees were relatively free from insect attack in August, probably because the thin bark permitted rapid evaporation and the consequent drying was unfavorable for borers, though *Dryocoetes* had made considerable progress in the large trees.

Hemlock. The 6-spotted buprestid, *Melanophila fulvoguttata* Harr., was numerous at Big Moose July 3 in the

burning of Ap. 30, on large hemlocks. Though they were somewhat green, none were observed on very small dead trees. A cerambycid, *Xylotrechus undulatus* Say, was observed in some numbers. Examination of these trees Aug. 10 resulted in finding some infested which showed no evidence of insect attack July 3, the larvae of *Melanophila fulvoguttata* Harr. probably being the principal offender. This is perhaps to be explained by this buprestid being on the wing mostly during July, and consequently there would not be a serious infestation till after the adults had flown for a period.

Balsam. Investigations July 2 on an area near Big Moose, burned over Ap. 30 resulted in finding several specimens of *Chrysobothris pusilla* Lap. & Gory on this tree, while *C. scabripennis* Lap. & Gory, were fairly common on the standing but badly burned balsams. Investigations Aug. 12 showed that the balsam compared with spruce was quite exempt from attack, probably due to the thinness of the bark and consequently quick drying of the sapwood. The lined ambrosia beetle, *Xyloterus lineatus* Kirby, was found in small numbers in July and its operations had progressed but little in August.

Poplar. Examinations July 7 of an area near Big Moose burned over May 14 resulted in finding a large species of *Xyleborus* in poplar.

Conclusions. Investigations the present season have shown that, while a number of insects are liable to attack burned trees within four to six weeks after injury, no very material injury is likely to result during the summer, except possibly from the work of ambrosia beetles. The other species either confine their operations so largely to the bark or else occur in such small numbers that for the present they may be neglected. The ambrosia beetles rarely extend their operations to a greater depth than 2 or 3 inches and as a consequence a considerable proportion of the lumber will be free of injury. This would hardly prove to be the case if the trees are allowed to remain standing a second season, at which time they will undoubtedly offer at-

tractive shelters for a number of other borers, some of which may penetrate the wood to a considerable depth and damage it very materially for other than firewood purposes. While prompt cutting of burned timber is advised wherever practical, the evidence at hand is not sufficient to indicate any very urgent necessity of its being removed prior to the winter following the attack. The insects now in the burned trees (if the latter are allowed to remain) will probably appear another spring and be numerous enough to cause considerable damage at least to weaker trees in the vicinity of the burned areas, and their multiplication in such places may eventually lead to a considerable extension of the damage. This is particularly liable to be the case with evergreen trees, and in the vicinity of Albany we have observed several localities where bark borer attack appeared to start with one or more infested trees, and the affected area was gradually increased till a considerable number of pines were destroyed.

It is not only advisable to cut the burned trees so far as possible during the winter, but they should also be removed from the land or at least gotten into water, so that the insects now under the dead bark will be unable to emerge and continue the attack. The same end may be attained in the case of bark borers, and they are the ones most likely to injure standing trees, by peeling the bark from the logs. This will hardly be practised in this county, even if it were profitable—something requiring demonstration.

VOLUNTARY ENTOMOLOGIC SERVICE OF NEW YORK STATE

The work of the last four years has been continued and a number of valuable observations added to our previous reports. The season of 1902 was unfavorable for the development of certain forms of insect life, and the same has been true to even a more marked extent in 1903. The latter, however, will probably go down in history as a season when plant lice or aphids were abnormally abundant and injurious to a great many plants throughout the entire State. 36 voluntary observers were appointed during

the season and but 21 of them rendered reports. This is largely due to the general scarcity of forms which lend themselves readily to observation, and the depredations of plant lice are so similar that most observers were unable to report on the outbreak in a satisfactory manner. It will be noted that the following reports contain some negative statements, which are of value because they emphasize the abnormal scarcity of various species. Too much dependence can not be placed on these reports, because with some exceptions they may be called local and not representative even of the county. It will also be observed that there are a number of conflicting statements, due to the belief by some parties that dry weather is favorable to the development of plant lice, while others state most clearly that the great increase in numbers of these pests was subsequent to the rains. It may be stated that we have not enough data to explain this difference and we are content at present to give opinions as they are transmitted. The observers all agree in reporting very cold, inclement weather in the early part of the season, and this undoubtedly had considerable effect in checking the appearance or in reducing the destructiveness of some of our more common injurious species.

Albany county [E. T. Schoonmaker, Cedar Hill]—Forest tent caterpillars (*Malacosoma disstria* Hübn.) hatched in limited numbers Ap. 23 and apparently have not suffered by the freeze. These insects caused practically no injury later in the season and consequently no report was made regarding the same. Elm leaf beetles (*Galerucella luteola* Müll.) occurred in limited numbers but were not abundant enough in the country to cause material damage.

Cattaraugus county [C. E. Eldredge, Leon]—Complaint of a looper caterpillar, probably a species of canker worm, was received June 10 with the statement that they had been observed on forest trees in that vicinity for several years, and that previously they had not appeared on apple trees. These insects were so near maturity that on June 17 no specimens were to be found. A soft scale (*Lecanium ? pruinosa* Coq.) was taken in some numbers from a trumpet vine. The unusually cold, inclement

weather kept insects well in control, and as a consequence there was comparatively little to report from this section.—*June 10*

Cattaraugus county [F. A. Fitch, Randolph]—Appletree tent caterpillars (*Malacosoma americana* Fabr.) appeared the latter part of April and were very abundant in neglected orchards, increasing immensely in numbers during the last two or three years. Squash bugs (*Anasa tristis* DeGeer) ruined a crop of squashes in this section last year. Cabbage butterflies (*Pieris rapae* Linn.) appeared about the middle of May, and the same was true of May bugs, species unknown, and various mosquitos. The white grub of the May beetle has not been as destructive as in former years.—*May 18*. Potato beetles (*Doryphora 10-lineata* Say), grasshoppers and the plum curculio (*Conotrachelus nenuphar* Herbst.) made their appearance May 26. Early in June curculios were reported as being at work, potato beetles as laying eggs, and plant lice as being present on cherrytrees. The latter are the ordinary black species (*Myzus cerasi* Fabr.) which has been unusually destructive and injurious in various sections of the State. Squash bugs appeared June 18, horn flies (*Haemotobia serrata* Rob. Desv.) the second week in June, and rose beetles (*Macrodactylus subspinosus* Fabr.) were very abundant on some rose bushes. Potato beetles are somewhat abundant and are laying eggs on potatoes. So far this season insects appeared to be less injurious than usual, probably on account of cold rains.—*June 22*. Large, green horseflies are quite troublesome and young grasshoppers are numerous on lowlands. Insect depredations are less than usual.—*July 8*. There are few mosquitos in the village and on the farm we saw none where commonly there have been millions. Ditching the land has undoubtedly aided very much in reducing their number. Flies are also less abundant than usual.—*July 22*. The first cabbage butterfly was observed in the field Aug. 11. A single mosquito was observed recently, though none had been seen for weeks before. Cabbage maggots (*Phorbia brassicae* Bouché) are working to some extent on cabbage, and the same is true of the cabbage louse

(*Aphis brassicae* Linn.) Grasshoppers are scarce as well as most other injurious insects.—*Aug. 17*

Cayuga county [Purley Minturn, Locke]—Appletree tent caterpillars (*Malacosoma americana* Fabr.) were observed for the first time May 5. Farmers have begun spraying. Very few injurious insects appeared owing probably to the extremely cold and frosty nights.—*May 5*. Colorado potato beetles (*Doryphora 10-lineata* Say) are very plenty, and the small, black flea beetle (*Crepidodera cucumeris* Harr.) is at work on potatoes and also feeding on various weeds in the potato field.—*June 11*

Chemung county [M. H. Beckwith, Elmira]—Cabbage butterflies (*Pieris rapae* Linn.) appeared Ap. 23. The Indian Cetonia (*Euphoria inda* Linn.) was observed May 1, and appletree tent caterpillars (*Malacosoma americana* Fabr.) the 2d. The latter do not appear to be as numerous as usual at this season of the year.—*May 8*. Currant worms (*Pteronus ribesii* Scop.) appeared on gooseberries May 8, asparagus beetles (*Crioceris asparagi* Linn.) May 11 and potato beetles (*Doryphora 10-lineata* Say) were first observed May 16. There were at this time no depredations of special importance.—*May 25*. Plant lice have been very abundant on plum and cherry trees but since the rains they are less numerous. Potato beetles are not very abundant and their eggs are developing slowly.—*June 30*. This has been a most remarkable season for insect depredations, as there have been very few species observed during the protracted dry weather. Early in the summer plant lice were quite abundant on cherry and plum trees and threatened for a time to cause considerable injury, but the wet weather came soon enough to prevent any great damage. Currant worms were less numerous than last year and the second brood was very small. Potato beetles were less destructive than usual and occurred in very small numbers. Cutworms were quite numerous, yet they caused less damage to plants than usual. Tobacco worms (*Phlegethontius 5-maculatus* Hübn.) were very scarce, in fact, only two were met with

this season, though much time was spent in tobacco fields. The striped cucumber beetle (*Diabrotica vittata* Fabr.) and the squash bug (*Anasa tristis* DeGeer) have been so few in number that their attacks were not noticed. The fall webworm (*Hyphantria textor* Harr.) was rather more abundant than last season.—*Oct. 8*

Dutchess county [H. D. Lewis, Annandale]—Appletree tent caterpillars (*Malacosoma americana* Fabr.) were first observed Ap. 20, and forest tent caterpillars (*Malacosoma disstria* Hübn.) on the 30th. A very few bud moth larvae (*Metocera ocellana* Schiff.) were observed May 1. Cold weather has kept insects in check and no species is remarkably abundant.—*May 4*. Tent caterpillars are, so far, much less abundant than for the past five years. The weather continues cold and dry and insects and fungi are developing slowly.—*May 12*. Tent caterpillars of both species are reported as causing some injury. Plant lice (*Aphis mali* Fabr. and *Myzus cerasi* Fabr.) are exceedingly abundant on apple and cherry trees respectively.—*May 27*. The latter have appeared recently and they are the only insects which are at all abundant. The weather continues cold and dry.—*June 1*. There is a great decrease in the number of caterpillars from last year and plant lice are exceedingly abundant.—*June 15*. Plant lice are still increasing and are the only insects which are of much importance. Tent caterpillars, both species, are not nearly so abundant as in former years. The weather is very wet at present.—*June 22*. Apple plant lice are present in enormous numbers and more abundant than they have been for 10 years. There are a few cutworms but other insects are scarce. The weather continues cold and very wet.—*June 25*. A very serious attack of pear psylla (*Psylla pyricola* Forst.) has developed within the last 10 days, and the crop will be seriously hurt. Apple aphid is still present in very large numbers, and potato beetles (*Doryphora 10-lineata* Say) are remarkable for their scarcity.—*July 10*. The apple aphid and the pear psylla continued in great abundance and have inflicted very serious damage, specially the latter. The

weather has been very wet and cold since June 1, and apparently favorable for the development of the above insects. The peartrees have suffered extremely, all the young growth being killed, and they are now starting a new growth from next year's buds. This wood can not ripen and the results must be very injurious. We visited one pear orchard of 600 trees where *Psyllas* were still very active and attacking the new growth as fast as it appeared. The pear crop in this section is ruined.—*Aug. 10*

Erie county [J. U. Metz, Swormville]—Striped asparagus beetle (*Crioceris asparagi* Linn.) was observed today for the first time. We have not been able to find any of the spotted species (*C. 12-punctata* Linn.). Quite a little wheat is down but we have not been able to detect any work of the Hessian fly (*Cecidomyia destructor* Say).—*May 28*. Currant worms (*Pteronous ribesii* Scop.) were observed yesterday in numbers for the first time. Rose beetles (*Macrodactylus subspinosus* Fabr.) are exceedingly numerous and causing considerable damage. Both moth larvae (*Tmetocera ocellana* Schiff.) are quite numerous and causing some injury. Not a trace of Hessian fly has been observed. Many young shoots of blackberries are affected by the gouty gall beetle (*Oberia bimaculata* Oliv.). Potato beetles (*Doryphora 10-lineata* Say) are numerous on early potatoes.—*June 11*. Rose beetles are very numerous and in one instance were so abundant that some cherrytrees were literally covered with them and looked as though they had been scorched by fire; not only the foliage but also the fruit was affected, and the insects were not above eating the grass beneath the trees. Grapevines are also being injured to some extent by these pests.—*July 6*

Genesee county [J. F. Rose, South Byron]—Cabbage butterflies (*Pieris rapae* Linn.) were first observed May 6, and potato beetles (*Doryphora 10-lineata* Say) were first noticed May 7. Tent caterpillars (*Malacosoma americana* Fabr.) are scarce as yet. The extremely cold, inclement weather of early May has kept many insects in check.—*May 11*. Cabbage worms were first observed on plants the 22d. Asparagus

beetles (*Crioceris asparagi* Linn.) are plenty. There are not many potato beetles as yet. Cigar case-bearers (*Coleophora fletcherella* Fern.) are very numerous in some orchards. Something has happened to tent caterpillars, as they are extremely scarce; so evident is this that it is a source of common remark. There are no evidences of injury by cankerworm.—*May 25.* The cabbage root maggot (*Phorbia brassicae* Bouché) is unusually numerous and very destructive to early cabbages. The four-lined leaf bug (*Poecilopsus lineatus* Fabr.) is quite abundant and, as usual, is indifferent as to what kind of plant it attacks, occurring with great impartiality on burdock, peppermint, sage, currant etc. Cankerworms are very scarce in this immediate vicinity, but are reported as having done considerable damage in orchards between here and Rochester. In a trip to Niagara Falls I observed several orchards between LaSalle and that place, which were brown from the work of this pest.—*June 3.* There is practically no Hessian fly (*Cecidomyia destructor* Say) as after inquiry at a grange meeting, only one farmer reported any, and that was in a field of late sown no. 6 white wheat. A similar inquiry regarding cankerworms and tent caterpillars resulted in statements that very few or none had been seen. There is some complaint of plant lice on plum and cherry trees.—*June 15.* The black or cucumber flea beetle (*Crepidodera cucumeris* Harr.) is much complained of and has not only perforated potato leaves but is said to be at work on corn and beans as well as tomatoes. The striped cucumber beetle (*Diabrotica vittata* Fabr.) is very numerous on squash, melon and cucumber vines, nearly destroying them in some gardens. Following our severe drouth we have had three weeks of drizzling rain, and plant lice are very bad on fruit and other trees. We have never seen them on so many varieties of trees till this year. The young growth of quinces for 6 or 8 inches on each shoot is a mass of lice, and the leaves are blackened and rolled up. This plant louse outbreak has been exceedingly severe and injurious to a great many plants. There is a very general complaint among cabbage growers about the root

maggot. The cabbage plant louse (*Aphis brassicae* Fabr.) is also abundant, curling the leaves and turning them blue.—*June 29*. Fall webworms (*Hyphantria textor* Harr.) appeared July 2 and are now quite numerous. The squash bug (*Anasa tristis* DeGeer) has not appeared. There was a fair crop of striped cucumber beetles and they have now disappeared. Cabbages are white with cabbage aphid. This is the first time this insect has been a serious pest in this locality. Plant lice are also exceedingly abundant on fruit trees. Pear psylla (*Psylla pyricola* Forst.) is very abundant and seriously injuring the crop.—*July 2*. Fall webworms are unusually numerous, and potato growers have had little difficulty in controlling the potato beetle. Cabbages are very seriously affected by the aphid. Not a squash bug has been seen.—*Aug. 17*

Greene county [O. Q. Flint, Athens]—No injurious insects have been observed except tent caterpillars (*Malacosoma americana* Fabr.), which appeared later than usual and are much scarcer at this date than has ever been known before. The weather was extremely dry and growers are spraying pear and plum trees.—*May 20*

Herkimer county [George S. Graves, Newport]—Black butterflies (probably *Euphydryas antiopa* Linn.), were observed for the first time Ap. 25, and the same is true of the cabbage butterfly (*Pieris rapae* Linn.). Cold winds and cloudy weather seem to have delayed the appearance of insects.—*Ap. 28*. Webs of the appletree tent caterpillar (*Malacosoma americana* Fabr.) began to appear Ap. 30 and were by no means abundant May 6. The weather has been too cold for any rapid increase in insect life.—*May 7*. Plant lice have appeared on wild cherrytrees, and the currant worm (*Pteronous ribesii* Scop.) is at work, both eggs and larvae being found. No nests of tent caterpillars have been observed this week. The weather is warm and dry.—*May 14*. Potato beetles (*Doryphora 10-lineata* Say) were observed May 16, and currant lice (*Myzus ribis* Fabr.) were just appearing on the leaves on the same date.—*May 21*. Black flea beetles (*Crepid-*

dodera cucumeris Harr.) are appearing on potato leaves, and some insect is feeding quite generally on plantains, (very probably *Dibolia borealis* Chev.). Horn flies (*Hæmatobia serrata* Rob.-Desv.) are quite numerous on cattle. An examination shows that eggs of the currant worm are abundant. Elm foliage is full of holes, probably the work of larvae of the elm flea beetle (*Disonycha triangularis* Say).—*May 27*. Terminal leaves of elms are badly twisted and wrinkled by aphid attack, very probably *Schizoneura americana* Riley. Potato beetles are very rarely seen, though many eggs have been observed. The foliage of the few potatoes above ground is badly eaten by the black flea beetle. Nests of the apple-tree tent caterpillar are very scarce and with but few tenants. Currant aphid continues abundant.—*June 3*. Rose beetles (*Macrodactylus subspinosus* Fabr.) were observed for the first time on rosebushes June 4, and considerable damage has been inflicted. A species of plant louse (*Chaitophorus negundinis* Thos.) has appeared somewhat abundantly on the ash-leaf maple. Grasshoppers are becoming quite abundant in old pastures. The scarcity of potato beetles is cause for general comment, and the black flea beetles are exceedingly numerous on potato and tomato vines.—*June 10*. A few full-grown forest tent caterpillar larvae (*Malacosoma disstria* Hübn.) were observed. Spittle insects are uncommonly abundant on grass under a spreading shade tree. Rose beetles (*Macrodactylus subspinosus* Fabr.) are abundant on apple-trees, on thorn apple, and very numerous on white daisy and dock. The daisy flowers are eaten off in many instances.—*June 17*. Potato beetle larvae were observed on one plant June 22, and a few striped cucumber beetles (*Diabrotica vittata* Harr.) were noticed on lima beans. The currant aphid (*Myzus ribis* Fabr.) is causing very little damage, while tomato and potato vines are considerably injured by the black flea beetle.—*June 24*. Currant leaves appear as though they had been eaten by the sawfly, though no larvae have been observed. The little plant louse (*Drepanosiphum aceris*

folii Thos.) appears to be quite common on a number of varieties of maple and is causing some injury.—*July 1.* Black-headed cabbage worms (*Evergestis stramenalis* Hübn.) are causing some injury to turnips. Some caterpillars, probably fall webworms (*Hyphantria textor* Harr.) have appeared in small numbers on an appletree. Plant lice are abundant on many plants, such as apple, elm, box-elder, birch, wild cherry, burdock, pigweed and dock. Though potato beetles were never so inconspicuous, there are plenty of grubs.—*July 22.* The maple aphid (*Drepanosiphum acerifolii* Thos.) appears to be the cause of much premature falling of leaves, the pests being generally distributed, occurring even in the tops of trees 60 feet high. Plant lice have appeared in some numbers on red rose bushes.—*July 29.* There is apparently another brood of black-headed cabbage worms at work, if size is any indication. Plant lice (probably *Aphis brassicae* Linn.), are numerous on turnips. The appletree plant louse (*Aphis mali* Fabr.) is abundant and seriously injuring appletrees. The pests are specially abundant on new, tender shoots. Cherrytrees are very little affected, and plumtrees more so, but in the latter case black knot is also prevalent. Grasshoppers are generally scarce, though in a few localities they are abundant. Cabbage butterfly (*Pieris rapae* Linn.) has not been very abundant so far this season.—*Aug. 4.* A psocid (*Psocus? venosus* Burm.) was found in clusters of 200 or more on the trunks of maple, and a few were also observed on appletrees. In some cases the bark of the tree seemed to be whitened as though it were partially eaten, probably by the insects gnawing away the lichens and outer portions of the bark. Larvae of the elm flea beetle (*Disonycha triangularis* Say) are very plentiful on elmtrees near by and have severely injured the foliage.—*Aug. 12.* A small, yellowish leaf hopper (? jassid) is abundant on beans and has apparently caused considerable yellowing of the foliage. Yellow-necked appletree worm (*Datana ministra* Drury) is present in small numbers, and the same is also true of the fall webworm. The brown and black woolly bears (*Pyrharctia isabella*

Abb. & Sm.) were unusually numerous in a timothy field.—*Aug. 12.* Plant lice are numerous on beans, and on sunflowers there is a similar species. Codling moth larvae (*Carpocapsa pomonella* Schiff.) have begun operations, and wormy apples are not uncommon. Plant lice continue abundant on pigweed.—*Aug. 19.* Horn flies (*Haematobia serrata* Rob.-Desy.) and horseflies have been very troublesome for the past two weeks. A few caterpillars of *Apateia americana* Harr. were observed on soft maple today. Fall webworms (*Hlyphantria textor* Harr.) are apparently more abundant than last year, occurring in some numbers on appletrees. Hornet nests are more numerous than usual.—*Aug. 25.* Butternut trees are very badly eaten in some places by *Datania integerrima* Gr. & Rob. Fall webworms continue to be unusually abundant.—*Sep. 1.* Plant lice (*Chaitophorus negundinis* Thos.) still continues abundant on box-elder. Apples are comparatively scarce this year and appear to be wormier than ever. A few webworm nests were observed on lilac and alder today.—*Sep. 16.* Pieris larvae are injuring foliage of cultivated nasturtiums to a considerable extent.—*Oct. 1*

Onondaga county [Mrs A. M. A. Jackson, Camillus]—First nest of an appletree tent caterpillar (*Malacosoma americana* Fabr.) was observed Ap. 26, and the present indications are that this insect will not be as abundant as usual. There is a report that Hessian fly (*Cecidomyia destructor* Say) is working in some fields.—*Ap. 28.* The blue or meat fly is quite abundant about houses. Cabbage butterflies (*Pieris rapae* Linn.) are about, though not numerous. Spotted lady beetles occur on many weeds and plants, and though abundant do not appear to be destructive. Tent caterpillars are not numerous and are causing very little injury. Cold, inclement weather has kept caterpillars and other insects in check. Examination of one wheat field showed no Hessian fly, and growers state that thus far none has been met with.—*May 6.* Cankerworms appeared May 12 and are quite abundant and destructive. The bud moth (*Trametocera ocellana* Schiff.) is at work on appletrees, though

not causing very much injury. The forest tent caterpillar (*Malacosoma? dissτρια* Hübn.) has appeared in very small numbers on chokecherry trees. The weather is dry and warm and consequently favorable to the development of insect life. Many clover leaves have small, round holes eaten in them, possibly the work of the clover leaf weevil (*Phytonomus punctatus* Fabr.).—*May 13.* Cankerworms are developing rapidly and have caused a great deal of injury. Ants of several species are quite abundant.—*May 20.* Red admiral butterflies (*Vanessa atalanta* Linn.) have appeared but are not as abundant as usual. The apple-tree tent caterpillar is quite scarce, only five webs or nests being observed in a 5 mile drive. Cankerworms are abundant, and while many trees have been injured to a considerable extent, none have been entirely defoliated. Potato beetles (*Doryphora 10-lineata* Say) have appeared and deposited some eggs. Cold weather is keeping insects in control. Green plant lice are somewhat abundant on rosebushes. Currant worms (*Pteronous ribesii* Scop.) are present in small numbers, though not causing much damage. Red admiral butterflies continue scarce and others are not so numerous as usual. Potato beetles and their eggs are very abundant on early potatoes. A white frost occurred May 31 and June 1, but did not seriously affect insects.—*June 1.* Plum curculios (*Conotrachelus nenuphar* Herbst.) have stung much fruit and considerable is dropping. Cankerworms have about all disappeared and have not caused as much injury as in former years. Many farmers think that tent caterpillars hatched during the warm days of March and were killed by the cold weather which followed, or else perished from lack of food. This hardly seems probable, as instances have been recorded where eggs of this species hatched in the fall and the caterpillars successfully survived the winter in the latitude of Missouri.—*June 10.* There are but few cocoons of the tent caterpillars, and this appears to be due in part to the continuous wet weather of 1902, when the caterpillars ate but little, were not healthy and appeared to be only partly grown at the time they spun up. A very

few Hessian flies are to be found in the "flaxseed" stage, though no complaints of their work have been received. A leaf miner, probably *Pegomyia vicina* Lintn., is very abundant in a large field of beets. Spittle insects are quite common in certain fields of grass. Potato beetle eggs are hatching, but the grubs do not appear to be as numerous as the old ones and are causing comparatively little damage. Black flea beetles (*Crepidodera cucumeris* Harr.) have caused some injury to both tomato and potato vines. Striped cucumber beetles (*Diabrotica vittata* Fabr.) are present on pumpkin vines but are not causing much injury. No squash bugs (*Anasa tristis* DeGeer) have been observed this year, though they are usually very abundant and destructive in this section. Rose beetles (*Macrodactylus subspinosus* Fabr.) are quite destructive to rose bushes, though late in appearing, and leaf hoppers have also caused some injury to rose bushes. Peas are more free from weevils (*Bruchus pisorum* Linn.) than usual, but the vines are being eaten by a green worm similar to the cabbage worm. House flies are not as abundant as usual.—*June 29*

Orange county [J. M. Dolph, Port Jervis]—A few mourning cloaks (*Eupanesa antiopa* Linn.) and some *Colias* butterflies have appeared. Many small bees are frequenting plum blossoms.—*April 23*. Plant lice (*Aphis mali* Fabr. and *Myzus cerasi* Fabr.) are very numerous, specially on apple and cherry trees and rose bushes. Tomato plants are also affected by a species of plantlouse which may be *Rhopalosiphum solani* Thos. In general there are fewer insects than usual, due probably to the exceedingly dry weather.—*June 2*. Potato beetles (*Doryphora 10-lineata* Say) have made their appearance in considerable numbers, the first abroad on May 20, and the first larvae being observed June 9. Hundreds of lady-beetles were found on a crimson rambler rose, three or four on a leaf. We have never seen them in such great numbers before. This bush had been badly infested by plant lice, and the lady beetles were undoubtedly attracted by their prey. The currant

worm (*Pteronusus ribesii* Scop.) has caused some injury though it has not been abundant as in former years. The spiny elm caterpillars (*Euvanesa antiopa* Linn.) have stripped the leaves from a number of North Carolina poplars planted for shade tree purposes.—*June 11.* Striped cucumber beetles (*Diabrotica vittata* Fabr.) have appeared in considerable numbers. Pear and cherry slug (*Eriocampoides limacina* Retz.) is inflicting much injury on the foliage of peartrees. Rose beetles (*Macrodactylus subspinosus* Fabr.) have been specially numerous and abundant this year. The foliage of very few bushes has escaped being eaten or seriously disfigured.—*June 30*

Rockland county [S. B. Husted, Blauvelt]—Appletree tent caterpillars (*Malacosoma americana* Fabr.) appeared as usual but have not done as much injury as in former years. No potato beetles have appeared, while plant lice (*Myzus cerasi* Fabr. and *M. ribis* Fabr.) are unusually abundant on cherry and currant bushes. Cutworms are reported rather plenty and cedar birds have been unusually numerous on cherry-trees, probably being more noticeable on account of the scarcity of fruit.—*June 7*

St Lawrence county [C. J. Locke, Ogdensburg]—June bugs and grubs were abundant May 1. 90% of the birch trees in this section are affected by a borer, possibly the bronze birch borer (*Agilus anxius* Lec.), and an equal proportion of poplar trees are also injured. These latter may possibly be affected by a buprestid, though it is not improbable that considerable damage is caused by the poplar borer (*Saperda calcarata* Say). The gouty gall beetle (*Oberia bimaculata* Oliv.) is causing considerable injury in blackberry patches. Appletree borers (*Saperda candida* Fabr.) are abundant and infest many appletrees. Woodpeckers are at work on infested trees, and have undoubtedly destroyed many grubs.—*May 16.* Mourning cloak butterflies (*Euvanesa antiopa* Linn.) were first observed May 18, and cabbage butterflies (*Pieris rapae* Linn.) on the 22d. Currant worms (*Pteronusus ribesii*

Scop.) put in appearance May 18, and the same is true of the appletree aphid (*Aphis mali* Fabr.).—*May 22.* Eggs of the potato beetle (*Doryphora 10-lineata* Say) were observed May 21, and shad flies or May flies, the 22d. Mosquitos were abundant on the 25th. Generally speaking, no insects are specially injurious.—*May 28.* Cucumber beetles (*Diabrotica vittata* Fabr.) were very numerous June 4; same was true on the 10th of strawberry weevil (? *Anthonomus signatus* Say) and potato beetles. White grubs are abundant and totally destroying oats.—*June 11.* Cabbage worms appeared on the 20th, and onion maggots (*Phorbia ceparum* Meigen) were at work the 22d. This latter insect has destroyed one fourth of the onion crop. Cabbages have likewise suffered from the maggot (*Phorbia brassicae* Bouché). Rose slugs were observed at work on the 23d.—*June 25.* A second brood of currant worms appeared July 1. Cabbage worms, cucumber beetles, plant lice and onion maggots are very numerous and destructive. The wet weather continues, accompanied by an increase of leaf-eating insects. The foliage of appletrees, plumtrees, maples and elms are all attacked by plant lice. Some apples are dropping and show no sign of injury except at the end of the stem, probably the work of the codling moth (*Carpocapsa pomonella* Schiff.).—*July 9.* Crane flies and dragon flies were numerous July 10, and a single specimen of the tomato worm (*Phlegethontius 5-maculatus* Haw.) was observed on the 15th. Cabbage worms, potato beetles and plant lice continue abundant and destructive. Mosquitos are abundant and rains continue. Striped cucumber beetles and plant lice are attacking vines, egg plants and wild tansy.—*July 16.* White marked tussock moths (*Notolophus leucostigma* Abb. & Sm.) were observed July 20, and dragon flies on the 15th. Potato beetles are abundant and plant lice very numerous, mosquitos are rare. Cool and wet weather has interfered with the successful application and efficiency of insecticides, and as a consequence caterpillars are abundant. Apples are dropping from the tree, and only about one quarter of the crop will be saved. Most of the trouble is

probably caused by the codling moth larvae.—*July 30.* Fall webworms (*Hypantria textor* Harr.) appeared July 15 on plum, apple and elm trees, and a species of sawfly on asters.—*Aug. 8.* Potato beetles continue numerous and destructive. Cool, wet weather has not affected the leaf-eating caterpillars or plant lice, both of which continue abundant.—*Aug. 14*

Saratoga county [C. W. Ferris, Schuyler]—Appletree tent caterpillars (*Malacosma americana* Fabr.) are present in some numbers and were not injured by a frost, the mercury dropping to 24 F. on May 2.—*May 5.* Cherry aphid (*Myzus cerasi* Fabr.) are abundant on sweet cherries, and a green plant louse is affecting Bosc peartrees very seriously.—*July 15*

Schenectady county [Paul Roach, Quaker Street, Schenectady co.]—Appletree tent caterpillars (*Malacosma americana* Fabr.) are just hatching on trees in warm situations. Their numbers are small, and but few egg clusters have been observed.—*May 1*

Schuyler county [Mrs Harriet S. Updyke, Logan]—Appletree tent caterpillars (*Malacosma americana* Fabr.) appeared for the first time May 8. They have not caused as much damage as usual.—*May 20*

Ulster county [George S. Clark, Milton]—Appletree tent caterpillars (*Malacosma americana* Fabr.) have been at work for two weeks and were not affected by the frost of April 12, even though they were not protected by a web.—*Ap. 23.* Tent caterpillar nests are present in large numbers except in localities where they were carefully destroyed the preceding year.—*Ap. 30.* Tent caterpillars continue to increase in size, and their nests are becoming more conspicuous. Aphid (*Myzus cerasi* Fabr.) are beginning to appear on cherrytrees. Currant worms (*Pteronous ribesii* Scop.) are abundant on bushes that were not sprayed last year, and a few occur on those that were treated.—*May 14.* There has been no increase in appletree tent caterpillars, and currant worms are few, specially on bushes that were sprayed last year. Plant lice (*Myzus cerasi* Fabr.) are increasing on

cherrytrees, and it is now too late to reach them because the leaves are so badly curled. Some plant lice (*Aphis mali* Fabr.) have developed on appletrees. The black flea beetle (*Crepidodera cucumeris* Harr.) is working on potato, tomato vines and eggplants. Some caterpillars, probably those of the gartered plume moth (*Oxyptilus periscelidactylus* Fitch) are not doing much damage.—*May 21*. Tent caterpillars are beginning to crawl, evidently preparatory to pupation, and are not more than one quarter as abundant as last year. Plant lice are numerous on cherrytrees, specially young ones. The red spider (*Tetranychus telarius* Linn.) is abundant on roses.—*May 28*. A few potato bugs have just appeared, and plant lice are more abundant on cherrytrees than usual. Tent caterpillars do not appear to be as energetic as usual, possibly they were weakened by the early frost. Elm leaf beetles (*Galerucella luteola* Müll.) are very scarce, not a sign of one could be found on a large tree which had its foliage entirely destroyed two years ago.—*June 4*. Heavy rains have washed many of the aphids from the trees. Many plant lice continue on rosebushes that have not been sprayed.—*June 12*. The recent continued rains have prevented much damage from insect pests. Squash bugs (*Anasa tristis* DeGeer) are abundant enough to destroy the vines unless controlled. Some pear psylla (*Psylla pyricola* Forst.) has appeared on the trees in various pear orchards in this vicinity.—*June 18*. Pear psylla is injuring many trees and causing much of the fruit to drop. Plant lice are abundant on both young pear and apple trees.—*July 2*

Warren county [C. L. Williams, Glens Falls]—May beetles appeared in large numbers May 9. The asparagus beetle (*Crioceris asparagi* Linn.) was observed in considerable numbers May 16. It has become distributed over a tract at least 8 miles long and is abundant.—*May 25*. Rose beetles (*Macrodactylus subspinosus* Fabr.) appeared about June 22, and the depredations of a gray cutworm attracted attention about the same time. The former are very abundant and feed on all kinds of vegetation. The zebra caterpillar (*Mamestra*

picata Harr.) was found at work on strawberry plants.—*June 9*. June beetles are exceedingly abundant; more so than we have known for years.—*July 3*. The stalk borer (*Papaipema nitela* Guen.) is at work in small numbers on various plants, and we have succeeded in detecting a parasite on the same, which proves to be a tachinid.

Wayne county [C. H. Stuart, Newark]—The first aphids were observed on roses May 5, and comparatively few plants were infested. No tent caterpillars or cankerworms have been observed, and the spotted asparagus beetle (*Crioceris 12-punctata* Linn.) has disappeared, though the common species (*C. asparagi* Linn.) is present in force. House flies are scarce and occur only on the sunny side of buildings.—*May 19*. Plant lice began to appear the latter part of May, and have been more abundant than we have ever known them to be before. They oblige us to keep a gang of 15 or 20 men and boys at work continuously in the nursery with a whale oil soap solution to keep them in check. Larvae of lady beetles are more than usually abundant and are undoubtedly doing good service. On our lawn the only trees or plants that have escaped plant lice are poppies and evergreens; everything else is literally covered with them, or at least was so a week ago. Now the lady beetles are beginning to get the upper hand of the pests.—*July 2*

Westchester county [F. R. Calkins, Ossining]—Elm leaf beetles (*Galerucella luteola* Müll.) appeared May 3 and have been increasing rapidly but have caused no serious damage.—*May 4*. Bumble flower beetles (*Euphoria inda* Fabr.) were flying about in considerable numbers. Hundreds of them were observed, though there was no evidence of material injury. Grasshoppers were first seen May 6 and have become very numerous. Striped cucumber beetles (*Diabrotica vittata* Fabr.) appeared in large numbers on the 8th. The first Colorado potato beetles (*Doryphora 10-lineata* Say) were observed on the 15th. Appletree tent caterpillars (*Malacosoma americana* Fabr.) are causing a great deal of injury in this section, and species of plant lice are curling the leaves of various shrubs in this vicinity.—*May 18*. The majority of elms in this

section are in very bad condition owing to the work of the elm leaf beetle. Striped cucumber beetles continue very numerous, and potato beetles have appeared in the past week in increasing numbers. It looks as though the apple-tree tent caterpillars had been destroyed by some climatic condition; possibly the severe rains in May and June. Since we had 31 days of rain with hardly a ray of sunshine, the webs are empty and there are no signs of cocoons. Mosquitos are somewhat scarce. The work of the pear midge (*Diplosis pyrivora* Riley) is very evident, and cherry borers (probably the fruit tree bark beetles *Scolytus rugulosus* Ratz.), have ruined some trees.—*July 13*

Westchester county [Mrs Edwin H. Mairs, Irvington-on-Hudson]—White marked tussock moth caterpillars (*Notolophus leucostigma* Abb. & Sm.) are injuring the foliage of a fine purple beech, which is also suffering severely from plant lice, probably the woolly beech aphid (*Phyllaphis fagi* Linn.). Mapletrees have dropped many leaves, probably because of plant lice injury. Very likely this is the work of *Chaitophorus aceris* Thos.—*June 29*. A curious worm (*Seiroidonta bilineata* Pack.) was found feeding on foliage of purple beech. Mosquitos are more abundant than ever. Elm leaf beetle larvae (*Galerucella Inteola* Müll.) are crawling along the trunks of infested trees, the foliage of which is turning brown. American, English, weeping and slippery elms are all attacked. Maple and beech trees are still suffering from plant lice injury. Some red bugs are present on the infested trees.—*July 12*

Wyoming county [W. H. Roeper, Wyoming]—Appletree tent caterpillars (*Malacosoma americana* Fabr.) were first observed May 2. They are present in small numbers, and some think this is due to the excessively cold weather.—*May 9*. Insects of various kinds are much scarcer than usual.—*May 18*. Tent caterpillars are not causing much injury though canker-worms are working to some extent. The weather continues very cold at night, and it is exceedingly dry.—*May 25*. Codling moth larvae (*Carpocapsa pomonella* Schiff.) are unusually abundant in this locality, and apple aphid (*Aphis mali* Fabr.) is very numerous and rolling the leaves to a con-

siderable extent. The injury is so severe that it would not be surprising if a considerable proportion of the foliage dropped. Potato beetles (*Doryphora 10-lineata* Say) are present in large numbers. Plant lice are also working on forest trees in about the same way as on fruit trees. The weather continues very dry and appears to be favorable to plant lice. The apple crop will be only about one quarter its normal size, and pears are almost a failure. Plant lice continue to be the most destructive form in this section, and the injury is so severe that some trees have half their leaves badly curled by the pests. A good rain has benefited crops very much.—*June 15.* Maple foliage is dropping to a considerable extent, probably as a result of injury by plant lice (*Drepanosiphum acerifolii* Thos.)—*July 3*

LIST OF PUBLICATIONS OF THE ENTOMOLOGIST

The following is a list of the principal publications of the entomologist during the year 1903. 70 are given with the title,¹ place, time of publication and a summary of the contents of each. Volume and page number are separated by a colon, the first superior figure tells the column, and the second the exact place in the column in ninths; e.g. 67:974¹⁶ means volume 67, page 974, column 1, beginning in the sixth ninth, i.e. about two thirds of the way down.

Turnips. Country Gentleman, Nov. 27, 1902, 67:974¹⁶

The work of the cabbage root maggot, *Phorbia brassicae* Bouché, in turnips is identified and remedial measures discussed.

Experimental Work in New York State against the San José Scale
[*Aspidiotus perniciosus* Comst.] U. S. Dep't Agric.
Div. Ent. Bul. 37, n.s. 1902. p.35-36

Discussion of results obtained with 20% mechanical crude petroleum emulsion and whale oil soap.

Notes for the Year in New York. U. S. Dep't Agric. Div. Ent. Bul.
37, n.s. 1902. p.102-3

Brief records of injury by grapevine root worm, *Fidia viticida* Walsh; grapevine leaf hopper, *Typhlocyba comes* var. *vitis* Harr.;

¹Titles are given as published, and in some instances they have been changed or supplied by the editors of the various papers.

appletree tent caterpillar, *Clisiocampa* [Malacosoma] americana Fabr.; forest tent caterpillar, *Clisiocampa* [Malacosoma] disstria Hübn. and fall webworm, *Hyphantria cunea* Drury [textor Harr.].

Observations on Certain Insects Attacking Pine Trees. U. S. Dep't Agric. Div. Ent. Bul. 37, n.s. 1902. p.103-4

Records of injuries by *Tomicus calligraphus* Germ., *T. pini* Say and also of *Monohammus confusor* Kirby and *Dendroctonus terebrans* Oliv.

Potato Wireworms. Country Gentleman, Dec. 4, 1902, 57:992¹³

General remedial measures for wireworms are briefly discussed.

Crude Petroleum as an Insecticide. Soc. Promotion Agric. Sci.

Proc. 23d An. Meeting 1902, p.86-95; separate p.1-10 received Dec. 24, 1902

A review of experiments with crude petroleum and summary of results in controlling San José scale, *Aspidiotus perniciosus* Comst.

Maggots in Mushrooms. Country Gentleman, Jan. 1, 1903, 68:615

Brief account of species injuring mushrooms and remedies therefor, *Phora agarici* Lint. and species of *Sciara* being mentioned in particular.

Entomology. U. S. N. Y. Handbook 16, revised Dec. 1902, p.1-12, issued Jan. 3, 1903

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Grapevine Root Worm [*Eidia viticida* Walsh]. N. Y. State

Mus. Bul. 59. 1902. p.49-84, 1 col.pl. 4 halftones

Issued Jan. 5, 1903. Republished in great part in issues of *Grape Belt* [Dunkirk N. Y.] for Jan. 9, 13, 20, 27, Feb. 3, 10.

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Cucumber Beetle. Country Gentleman, Jan. 15, 1903, 68:43²⁴

Remedial measures for the striped cucumber beetle, *Diabrotica vittata* Fabr.

Insecticides and Notes. Country Gentleman, Jan. 15, 1903, 68:47³⁵

Summary of results obtained with insecticides against San José scale, *Aspidiotus perniciosus* Comst., and notes on the Chinese ladybug, *Chilocorus similis* Rossi, and the grapevine root worm, *Fidia viticida* Walsh.

Beware the Pea Weevil. Country Gentleman, Jan. 22, 1903, 68:63⁴²

Injuries by *Bruchus pisorum* Linn. in Canada and means of controlling.

Legislation against Pests. Country Gentleman, Jan. 29, 1903, 68:89²⁵

General discussion of the efficacy of nursery inspection work with comments on present conditions.

The San José Scale. Country Gentleman, Feb. 19, 1903, 68:158¹¹

Comparative value of crude petroleum emulsion, lime, salt and sulfur mixture and whale oil soap for *Aspidiotus perniciosus* Comst.

Beneficial Insects. Country Gentleman, Mar. 5, 1903, 68:206³³

General observations on the establishment of *Scutellista cyanea* Motsch, *Novius cardinalis* Mask. and *Chilocorus similis* Rossi in the United States.

Scale Insects. Worcester [Mass.] Evening Gazette, Mar. 12, 1903, p.1

Summary notice of scale insects with special reference to remedies for the San José scale, *Aspidiotus perniciosus* Comst.

Arsenate of Lead. Country Gentleman, Mar. 19, 1903, 68:252¹⁷

Formula and method of preparation.

Looper Caterpillar. Country Gentleman, Mar. 19, 1903, 68:252²³

Description too brief to permit identification of the geometrid.

Grapevine Root Worm. Country Gentleman, Mar. 19, 1903,
68:255³⁴

Corrects reported error and gives estimates of damage by *Fidia viticida* Walsh.

Recent Work with Insecticides in the East. Col. State Bd Hort.
Rep't 1902. 1903. p.121-27

Brief discussion of the value of arsenate of lead, crude petroleum, the lime, salt and sulfur mixture and whale oil soap as insecticides.

Fleas. Country Gentleman, Mar. 26, 1903, 68:276¹⁶

Brief account of life history with various repressive measures.

Appletree Bark Louse. Country Gentleman, Mar. 26, 1903, 68:276²⁴

Remedial measures for *Mytilaspis pomorum* Bouché [*Lepidosaphes ulmi* Linn.].

Insecticides and Fungicides. U. S. N. Y. Handbook 18, p.16

More important formulas recommended with general directions for use.

Pea Weevil. Country Gentleman, Ap. 2, 1903, 68:293²⁴

Discussion of rise in temperature in peas infested with *Bruchus pisorum* Linn. and methods of controlling the pest.

San José Scale. Country Gentleman, Ap. 2, 1903, 68:300¹²

No danger of *Aspidiotus perniciosus* Comst. spreading from infested wood cut in early spring.

Elm Leaf Beetle. Schenectady Daily Union, Ap. 3, 1903, p.7

Nearly the same in Evening Star [Schenectady] Ap. 3, p.12.

Extracts from Museum Bulletin 57 on *Galerucella luteola* Müll., with special reference to local conditions.

Shade Tree Ratings. Street forestry report on the selection, planting, cultivation and care of street shade trees by Fred-
eric Shonnard, Dep't Public Works, Yonkers, 1903

Ratings of comparative immunity from insect enemies of various shade trees.

Dust and Other Sprays. Country Gentleman, Ap. 16, 1903,
68:350²³

Brief discussion of various insecticides with special reference to scale insects and dry or dust sprays.

Advice about Spraying. Country Gentleman, Ap. 30, 1903,
68:392²³

General directions for spraying with references to convenient literature.

Arsenate of Lead. Country Gentleman, May 7, 1903, 68:410³⁵

Its preparation from arsenic, soda and sugar of lead not advisable. Directions are given for making it.

Literature of American Economic Entomology. Am. Ass'n Eco.

Ent. 15th An. Meeting, Presidential address, Washington D. C.

Dec. 26, 1902. U. S. Dep't Agric. Div. Ent. Bul. 40, n.s. 1903.

p.7-22

Also published separately.

After a general review with a few statistics regarding the amount of literature relating to some of the more notorious insects, the following topics were discussed: Newspaper and Minor Articles; Reports; Bulletins; Journals; General Works and Indexes.

Work and Observations in 1902. N. Y. State Fruit Growers Ass'n Rep't 1903, p.92-94. Rec'd May 15

Results obtained with crude petroleum, whale oil soap and lime, salt and sulfur against San José scale, *Aspidiotus perniciosus* Comst. Notes on the establishment of *Chilocorus similis* Rossi and work of grapevine root worm, *Fidia viticida* Walsh.

Elm Leaf Beetle Ravages. Argus [Albany] May 16, 1903; New York Times, May 17; Rensselaer County Standard [Hoosick Falls] May 22, 1903, p.4

Summary of injuries by *Galerucella luteola* Müll. in Hudson river valley.

New York Entomologic Service. Country Gentleman, May 21, 1903, 68:451³⁶

Summary of reports from voluntary observers.

Diseases and Pests. N. Y. State Lib. Bul. 80. Review of Legislation 1902, p.837-38

Summary of recent laws relating to plant diseases and insect enemies.

Importance of Injurious Insects Introduced from Abroad. Soc.

Promotion Agric. Sci. Proc. 24th An. Meeting 1903, p.39-48; separate, p.1-10

Summarized account of injuries with classified lists of introduced species and notes on the relative importance of various species.

New York Entomologic Service. Country Gentleman, May 28, 1903, 68:471³³

Summaries of reports from voluntary observers.

18th Report of the State Entomologist on Injurious and Other Insects of the State of New York 1902. N. Y. State Mus. Bul. 64. 1903. p.89-193, 1 lith. 5 halftones

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New York Entomologic Service. Country Gentleman, June 4, 1903, 68:498¹⁴

Summary of reports from voluntary observers.

Remedies for Grapevine Root Worms. Grape Belt, June 16, 1903, p.2

Brief statement of remedial measures for *Fidia viticida* Walsh.

New York Entomologic Service. Country Gentleman, June 18, 1903, 68:530³⁸

Summary of reports from voluntary observers.

Hints to Fruit Growers and Truckers. Am. Agric. June 20, 1903, 71:648²⁴

Briefly discusses the grapevine root worm, *Fidia viticida* Walsh, injuries in Chautauqua grape belt and remedies for same, and also the plum curculio, asparagus beetles, and insect enemies of squash.

New York Entomologic Service. Country Gentleman, June 25, 1903, 68:551¹²

Summary of reports from voluntary observers.

Destroying Flies. Country Gentleman, June 25, 1903, 68:561²¹

Destructive and preventive measures for the house fly, *Musca domestica* Linn.

Grapevine Root Worm. Grape Belt, June 26, 1903, p.1, 6

Beetles attack best vineyards, no decided migration, figures on efficacy of destroying pupae and remarks on value of beetle catchers and arsenical poisons for *Fidia viticida* Walsh.

Mosquitos. N. Y. State Mus. folder. Sp.

Issued June 29, 1903.

Brief description with discussion of habits, life history, genera and species, methods of controlling and collecting.

Grapevine Root Worm. Grape Belt, June 30, 1903, p.4

Results of breeding from entire vines and efficiency of beetle catchers for *Fidia viticida* Walsh.

New York Entomologic Service. Country Gentleman, July 2, 1903, 68:578³³

Summary of reports from voluntary observers.

Plant Lice. Country Gentleman, July 9, 1903, 68:590²⁷

Remedial measures for plant lice on fruit trees.

Killing Ants. Country Gentleman, July 9, 1903, 68:590³²

Method of destroying ants in nests.

Rose Beetles. Country Gentleman, July 9, 1903, 68:590³⁴

Methods of destroying the beetles, *Macrodactylus subspinosus* Fabr.

New York Entomologic Service. Country Gentleman, July 9, 1903, 68:590⁴⁵

Summary of reports from voluntary observers.

About Maple Tree Borers. Rome Daily Sentinel, July 10, 1903

Methods of controlling the sugar maple borer, *Plagionotus speciosus* Say.

Plant Lice. Country Gentleman, July 16, 1903, 68:610²⁷

Comments on unusual abundance of plant lice and remedies for the same.

New York Entomologic Service. Country Gentleman, July 16, 1903, 68:610⁴⁷

Summary of reports from voluntary observers.

Mosquitos. Sunday [Albany] Press, July 19, 1903, p.6

Reprint of portions of mosquito folder.

Spray for Potatoes. Country Gentleman, July 23, 1903, 68:630¹⁷

Advises arsenate of lead for potato beetles and bordeaux mixture for fungus.

New York Entomologic Service. Country Gentleman, July 23, 1903, 68:630⁴³

Summary of reports from voluntary observers.

Plant Lice. Country Gentleman, July 30, 1903, 68:650³⁴

Remedies for the pests.

New York Entomologic Service. Country Gentleman, July 30, 1903, 60:650⁴⁵

Summary of reports from voluntary observers.

Forest Fires and Insect Attack. Am. Lumberman, Aug. 8, 1903, p.15

Preliminary report on investigations in burned areas in the Adirondacks.

Aquatic Nematoceros Diptera by Oskar Augustus Johannsen.

Reprint from N. Y. State Mus. Bul. 68. 1903. p.328-441

Issued Aug. 11, 1903.

This paper includes a key to families of nematoceros diptera with accounts of the net-winged midges (Blepharoceridae), black flies (Simuliidae) and mosquitos (Culicidae).

Tulip Tree Scale. Country Gentleman, Aug. 20, 1903, 68:712²⁵

Brief notice with remedies for *Lecanium* [*Eulecanium*] *tulipiferae* Cook.

Summary of Root Worm Situation and Experiments. Grape Belt, Sep. 4, 1903, p.1; Jamestown Journal, Sep. 4, 1903, p.1; Country Gentleman, Sep. 24, 1903, 68:828²⁷

Brief summary of observations and experimental work on *Fidia viticida* Walsh in 1903.

Mosquitos on High Ground. Country Gentleman, Sep. 10, 1903, 68:781²⁴

Brief comments on the breeding habits and methods of controlling these insects.

Aquatic Chrysomelidae and a Table of the Families of Coleopterous Larvae by Alex. D. MacGillivray. Reprint from N. Y. State Mus. Bul. 68. 1903. p.288-331

Issued Sep. 12, 1903.

This paper includes a key to families of coleopterous larvae and a monograph of the subfamily Donaciinae, family Chrysomelidae.

Aquatic Insects of New York State. N. Y. State Mus. Bul. 68. 1903. p.199-517, 52 pl. (3 col.) by James G. Needham Ph.D., professor of biology, Lake Forest Univ.; A. D. MacGillivray Ph.D., instructor in entomology, O. A. Johannsen M.S., instructor in civil engineering, both of Cornell Univ.; and K. C. Davis Ph.D., professor of horticulture, West Virginia Univ.
 Issued Sep. 28, 1903.

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Sialididae of North and South America by K. C. Davis. Reprint from N. Y. State Mus. Bul. 68. 1903. p.441-87

Issued Sep. 30, 1903.

A systematic and biologic account of this group.

Two Tree Pests. Country Gentleman, Oct. 1, 1903, 68:852⁴³

Pear psylla, *Psylla pyricola* Forst. probably weakened the pear trees at Hartley Hall Pa., so that they were attacked by the fruit tree bark beetle, *Scolytus rugulosus* Ratz. Destruction of the infested trees by fire is advisable. The maple is probably infested by *Sesia acerni* Clem. Preventive measures are indicated.

Chinese Lady Bugs. Country Gentleman, Oct. 8, 1903, 68:871¹⁸

Records establishment and breeding of *Chilocorus similis* Rossi at Kinderhook N. Y.

INSECT EXCHANGE

The state collection of insects contains large numbers of many local, and in some cases somewhat rare forms. This, in connection with the fact that many species are not represented, and specially in view of the economic importance of introduced insects, led us to inaugurate a system of exchanges the past summer. Those offered for exchange are, in every case, only such as can be

spared without detriment to the general collections, and in return it has been our desire to obtain, so far as possible, species of economic importance in other sections of this country or any other countries, specially those which might develop into injurious pests. A preliminary exchange list was sent out in the early summer, and the results have been very gratifying, since we have been able by this means, to make a number of extremely valuable additions to the state collections. This is specially true in the case of Coccidae, and was largely possible through the kindness of Prof. V. L. Kellogg of Leland Stanford Jr University, who was able to offer us some extremely desirable Californian and Japanese scale insects in exchange for some of our native forms. Another very desirable exchange was arranged with Prof. F. H. Snow of Kansas University, who sent valuable Diptera and some cotypes, all determined by the noted authority in this group, Dr S. W. Williston. The species, 418 in number, acquired in this manner are listed below.

SPECIES RECEIVED IN EXCHANGE

The source of various species listed below, is indicated by superior figures following the author of the species, as follows:

1, from Prof. C. P. Gillette, Agricultural College, Fort Collins Col.; 2, from Prof. V. L. Kellogg, Leland Stanford Jr University, California; 3, from E. M. Ehrhorn, Mountain View Cal.; 4, from Prof. F. H. Snow, University of Kansas, Lawrence Kan.; 5, from Prof. E. A. Popenoe, state entomologist, Topeka Kan.; 6, from Prof. H. Garman, Agricultural Experiment Station, Lexington Ky.; 7, from J. G. Sanders, 8, from Prof. Herbert Osborn, both of the Ohio State University, Columbus O.

Hymenoptera

Bombus separatus Cress.¹
B. sylvicola Kirby¹
B. putnami Cress.¹
B. proximus Cress.¹
B. nevadensis Cress.¹
B. morrisonii Cress.¹
B. mixtus Cress.¹
B. juxtus Cress.¹
B. flavifrons Cress.¹

B. bifarius Cress.¹
B. appositus Cress.¹
Psithyrus insularis Cress.¹
Anthopora vallorum Ckll.¹
A. urbana Cress.¹
A. smithii Cress.¹
A. occidentalis Cress.¹
Synhalonia frater Cress.¹
Melissodes obliqua Say¹

Diadasia australis Cress.¹
D. diminuta Cress.¹
Megachile montivaga Cress.¹
M. fidelis Cress.¹
Lithurgus apicalis Cress.¹
Authidium maculifrons Smith¹
A. interruptum Say¹
Coelioxys gilensis Kill.¹
Augochlora coloradensis Titus¹
Epeolus robustus Cress.¹
E. occidentalis Cress.¹

E. concavus Cress.¹
E. compactus Cress.¹
Nomada ridingsii Cress.¹
Vespa occidentalis Cress.¹
Polybia flavitarsis Sauss.¹
Odynerus taos Cress.¹
O. foraminatus Sauss.¹
Crabro 6-maculatus Say¹
Philanthus flavifrons Cress.¹
Eucerceris fulvipes Cress.¹

Coleoptera

Hylastes longus Lec.⁴
Scolytus 4-dentatus Say⁵
Pityogenes pondrosae Hopk.¹
Tomicus integer Eich.¹
Calandra oryzae Linn.⁶
Baris strenua Lec.⁵
Thysanocnemis helvolus Lec.⁵
T. fraxini Lec.⁵
Anthonomus squamosus Lec.¹
Tachypterus 4-gibbus Say⁵
Lixus macer Lec.⁵
Rhynchites hirtus Fabr.⁵
Epicauta corvina Lec.⁵
Crymodus discicollis Lec.¹
*C. exiguus*⁵
Bruchus fraterculus Horn¹
B. discoideus Say⁵
B. 4-maculatus Fabr.⁵
B. minimus Say¹
Spermophagus robiniae Sch.¹
Chelymorpha phytophagica Cr.⁵
Cassida pallidula Boh.⁵
C. ellipsis Lec.⁵
Diabrotica lemniscata Lec.⁴
Monocesta coryli Say⁴
Lina lapponica Linn.⁶
Colaspis favosa Say⁴
Paria viridicyanea Cr.⁴
Myochrous denticollis Say⁴
Fidia longipes Melsh.⁴
Exema conspersa Mann.⁴
E. dispar Lec.⁵
Saxinis omogera Lac.⁴
Babia 4-guttata Oliv.⁴
Coccinoptera dominicana Fabr.⁴
C. axillaris Lec.⁴
Tetraopes canescens Lec.¹
T. femoratus Lec.¹
Dectes spinosus Say⁴

Plectrodera scalator Fabr.¹
Dorcaschema alternatum Say⁵
D. wildii Uhler⁵
Monohammus oregonensis Lec.¹
Monilema annulatum Say⁵
Leptura chrysocoma Kirby¹
Typocerus sinuatus Newm.⁵
Neoclytus muricatus Kirby⁴
Cyllene decorus Oliv.⁴
Tragidion fulvipenne Say⁴
Rhopalophora longipes Say⁴
Eburia 4-geminata Say⁶
Callidium janthinum Lec.¹
Prionus imbricornis Linn.⁵
Euphoria kernii Hald.⁵
E. kernii var.⁵
E. kernii black var.⁵
E. areata Fabr.⁵
Dynastes tityus Linn.⁶
Strigoderma arboricola Fabr.⁵
Polyphylla decemlineata Say¹
Bolboceras faretus Fabr.⁶
*Phanaeus palliatus*¹
Canthon praticola Lec.⁵
Hydnocera tabida Lec.⁴
H. subfasciata Lec.¹
Clerus sphegeus Fabr.⁴
C. nigriventris Lec.⁴
C. ichneumoneus Fabr.⁵
C. spinolae Lec.⁵
Acmæodera pulchella Herbst.¹
Psiloptera drummondi Lap. & Gory.⁵
Gyascutus obliteratus Lec.¹
Limonius canus Lec.¹
Elatr apicatus Say¹
Cryptohypnus pectoralis Say¹
Plegaderus nitidus Horn¹
Hister instratus Lec.¹
Orphilus niger Rossi¹

Dermestes fasciatus *Lec.*¹
Silvanus planatus *Geru.*¹
Languria laeta *Lec.*¹
Hyperaspis lateralis *Muls.*¹
Brachyacantha dentipes *Fabr.*⁴
Exochomus contristatus *Muls.*⁴
E. aethiops *Blund.*²
Coccinella abdominalis *Say*⁴
C. annexatus *Cr.*¹
C. monticola *Muls.*⁴
C. transversoguttata *Fabr.*¹

Hippodamia sinuata *Muls.*¹
Olibrus vittatus *Lec.*¹
Homalium humerosum *Faur.*¹
Homalota lividipennis *Maun.*¹
Dineutes assimilis *Aube.*⁵
Nothopus zabroides *Lec.*¹
Cymindis planipennis *Lec.*¹
Lebia atriceps *Lec.*¹
Anoplitahmus horni *Garman*⁶
Tetracha virginica *Liun.*⁶

Diptera

Cistogaster immaculata *Macq.*⁴
Gymnosoma fuliginosa *Descr.*⁴
Xanthomelana arcuata *Say*⁴
Hemysda aurata *Descr.*⁴
Epigrammia lucens *Town.*⁴
Belvoisia bifasciata *Fabr.*⁴
B. unifasciata *Descr.*⁴
Ocyptera carolinae *Descr.*⁴
O. dosiades *Walk.*⁴
Liunaemyia comta *Fall.*⁴
Blepharipeza adusta *Locw.*⁴
Hilarella polita *Town.*⁴
Gonia capitata *DeG.*⁴
Spallanzania hebes *Fall.*⁴
S. hesperidarum *Will.*⁴
Tricophora ruficauda *v. d. W.*⁴
Peleteria robusta *Wied.*⁴
Archytas analis *Fabr.*⁴
A. aterrima *Descr.*⁴
A. hystrix *Wied.*⁴
A. lateralis *Macq.*⁴

Echinomyia algens *Wied.*⁴
E. decisa *Walk.*⁴
E. hystriosa *Will.*⁴
Epalpus bicolor *Will.*⁴
E. signifera *Will.*⁴
Bombyliomyia abrupta *Wied.*⁴
Dejeania vexatrix *O. S.*⁴
Paradejeania rutilioides *Jaen.*⁴
Jurinella ambigua *Macq.*⁴
Syrphus arcutatus *Fall.*⁸
S. umbellatarum *Schiner*⁸
Mesograpta marginata *Say*⁸
M. polita *Say*⁸
Rhingia nasica *Say*⁸
Heliophilus laetus *Locw.*⁸
Tropidia quadrata *Say*⁸
Spilomyia longicornis *Locw.*⁸
Chrysops callidus *O. S.*⁴
C. plangens *Wied.*⁴
Tabanus rhombicus *O. S.*⁴

LIST OF CULICIDAE FROM PROF. F. V. THEOBALD, ENGLAND

Myzomyia rossi *Giles*; India
Pyretophorus costalis *Locw*; West Africa
Myzorhynchus barbirostris *v. d. Wulp.*; Malay states
M. nigerrimus *Giles*; India
M. sinensis *Wied.*; Malay states
Nyssorhynchus fuliginosus *Giles*; India
N. jamesii *Theob.*; India
N. maculata *Theob.*; India
N. masteri *Skuse*; Australia
Cellia argyrotarsis *Descr.*; South Lucia
C. albipes *Theob.*; New Amsterdam

Janthinosoma lutzii *Theob.*; Rio de Janeiro
J. musica *Say*; Rio and New Amsterdam
Mucidus alternans *Westw.*; Australia
Eretmapodites quinquevittata *Theob.*; Uganda
Desvoidea obturbans *Walk.*; India
D. panactros *Giles*; India
Stegomyia fasciata *Fabr.*
S. scutellaris *Walk.*; Malay states
Stegomyia (Stegomyia) notoscripta *Skuse*; Australia and India
Theobaldia annulata *Meig.*; England

T. incidens Thomson; North America
T. spathipalpis Rondani; Madeira
Culex alboannulatus Macq.; Australia
C. annulioris Theob.; Transvaal
C. annulirostris Skuse; Australia and New Guinea
C. canadensis Theob.; Canada
C. cantans Meig.; Canada
C. concolor Desv.; India
C. confirmatus Arrib.; Rio de Janeiro
C. cylindricus Theob.; Australia
C. diversus Theob.; Europe
C. fatigans Wied.
C. gelidus Theob.; Malay states
C. luteolateralis Theob.; west and central Africa
C. mimeticus Noë; India and Malay states
C. occidentalis Skuse; Australia
C. ochraceus Theob.; central Africa
C. pulcriventer Giles; India
C. sylvestris Theob.; Canada
C. taeniorhynchus Wied.; Rio de Janeiro
C. tigripes Grandpré; Mauritius
C. viridiventer Giles; India
C. vittiger Skuse; Australia

Melaniconion atratus Theob.; Jamaica
Grabhamia pygmaeus Theob.; West Indies
G. vittata Theob.; New Mexico
Taeniorhynchus aurifer Theob.; Uganda
T. brevicellulus Theob.; Malay states
T. conopas Frau.; Malay states
T. fasciolatus Arrib.; British Guiana
T. fulvus Wied.; Para
Mansonia annulifera Theob.; India
M. annulipes Walk.; Malay states
M. titillans Walk.; British Guiana
M. uniformis Theob.; Malay states and Africa
Deinocerites cancer Theob.; West Indies and Uganda
Uranotaenia socialis Theob.; West Indies
Aedeomyia squammipenna Arrib.; Malay states
Phoniomyia longirostris Theob.; Trinidad
Sabethes remipes Wied.; Brazil
Limatus durhamii Theob.; para
Trichoprosopon (Joblotia) nivipes Theob.; Trinidad

Lepidoptera

Anaea andria Seud.⁶
Ceratomia catalpae Bdv.⁶
Eubaphe rubicundaria Hübn.¹
Arachnis picta, Pack.¹
Apantesis incorrupta Hy. Edw.¹
Parasemia plantaginis Linn.¹
Laphygma frugiperda Sm. & Abb.⁶
Oncocnemis augustus Harv.¹
Heliothis armiger Hübn.⁶
Autographa brassicae Riley⁶
Syneda howlandii Grote¹
Homoptera rubi Hy. Edw.¹

Nycteola proteella Dyar¹
Hydriomena sp.¹
Triprocris smithsonianus Clem.¹
Loxostege sticticalis Linn.¹
L. commixtalis Walk.¹
L. coloradensis Gr. Rob.¹
Cornifrons simalis Grote¹
Crambus teterrellus Zinck.¹
Thaumatopsis repanda Grote¹
Hulstea undulatella Clem.¹
Homoeosoma electellum Hulst.¹
Ethmia discostrigella Chamb.¹

Neuroptera

Raphidia oblita Hag.¹
Chrysopa externa Hag.¹

Brachynemurus nigrilabris Hag.¹
Platyphylax designata Walk.¹

Hemiptera

Homaloporus congruus *Uhl.*¹
 Perillus claudus *Say*¹
 Apateticus marginiventris *Stal.*¹
 Cosmopepla conspicillaris *Dallas*¹
 Carpocoris lynx *Fabr.*¹
 Thyanta custator *Fabr.*¹
 T. rugulosa *Say*¹
 Archimerus calcarator *Fabr.*¹
 Catorhintha guttula *Fabr.*¹
 Ficana apicalis *Dallas*¹
 Alydus quinquespinosus *Say*¹
 A. pluto *Uhl.*¹
 Darmistus subvittatus *Stal.*¹
 Scolopocerus secundarius *Uhl.*¹
 Nysius minutus *Uhl.*¹
 Orsillus scolopax *Say*¹
 Ischnodemus falcatus *Say*¹
 Geocoris pallens *Stal.*¹
 Heraeus insignis *Uhl.*¹
 Pamera bilobata *Say*¹
 Trapezonotus nebulosus *Fall.*¹
 Emblethis arenarius *Linn.*¹
 Rhyparochromus floralis *Uhl.*¹
 Melanocoryphus bicrucis *Say*¹
 M. facetus *Say*¹
 M. admirabilis *Uhl.*¹
 Lygaeus reclusianus *Say*¹
 Largus cinctus *H. Sch.*¹
 Dysdercus minimus *Say*¹
 D. albidiventris *Stal.*¹

Trigonotylus pulcher *Reut.*¹
 Callimiris tarsalis *Reut.*¹
 Resthenia insignis *Say*¹
 Lomatopleura caesar *Reut.*¹
 Hadronema militaris *Uhl.*¹
 Pocilloscytus¹
 Systratiotus americanus *Reut.*¹
 Camptobrochis nebulosus *Uhl.*¹
 Capsus brachycorus *Uhl.*¹
 Pycnoderes 4-maculatus *Guer.*¹
 Labops hesperius *Uhl.*¹
 Dicyphus californicus *Stal.*¹
 Orectoderus¹
 Anthocoris melanocerus *Reut.*¹
 Coriscus kalmii *Reut.*¹
 Repipta taurus *Fabr.*¹
 Apiomerus pictipes *H. Sch.*¹
 A. ventralis *Say*¹
 Hygrotrechus remigis *Say*¹
 Limnotrechus marginatus *Say*¹
 Hebrus concinnus *Uhl.*¹
 Cicada *var.* cassinii *Fish.*⁶
 Microvelia¹
 M. hornii *Uhl.*¹
 Salda interstitialis *Say*¹
 S. pallipes *Fabr.*¹
 Galgulus oculatus *Fabr.*¹
 Anisops platynemesis *Fieb.*¹
 Corisa abdominalis *Say*¹

Coccidae

Parlatoria pergandii *Comst.*² on Japanese orange; Stanford University Cal.
 P. floriniae²; Gifu-Ken, Japan
 Lepidosaphes ulmi *Linn.*² on apple; Stanford University Cal.
 L. newsteadii tokionis *Kuw.*² on Cordia; Tokyo, Japan
 L. gloverii *Paek.*² on orange; Kiushiu, Japan
 L. crawii *Okll.*² Angio Saitama-Ken, Japan
 Odonaspis secreta *Okll.*² on bamboo; Hikosan, Kiushiu, Japan
 Chrysomphalus rossi *Mask.*² on Araucaria bidwillii; Stanford University Cal.

C. obscurus *Comst.*² on Quercus coccinea; Columbus O.
 C. kelloggi *Kuw.*² Chikujō-gun, Kiushiu, Japan
 C. aurantii citrinus *Coq.*² Mazatlan, Mexico
 C. aonidium *Linn.*² on fern; Tokyo, Japan
 Pseudaonidia paeoniae *Okll.*² on Aoshia; Hikosan, Kiushiu, Japan
 Aspidiotus rapax *Comst.*^{2, 8} on laurel; Stanford University Cal.
 A. perniciosus *Comst.*² on peach; Stanford University Cal.
 A. lataniae *Sign.*² Tokyo, Japan
 A. hederæ *Vall.*² on Sequoia sempervirens; Stanford University Cal.

- A. glanduliferus* *Ckll.*⁷ on *Pinus sylvestris*; Columbus O.
- A. coniferarum shastae* *Cole*² on cypress; Lake co. Cal.
- A. californicus* *Cole*² on *Pinus ponderosa*; Cobb Mt, Lake co. Cal.
- A. aesculi* *Johus.*² on buckeye; San Mateo Cal.
- Leucaspis kelloggi* *Cole*² on *Abies concolor*; Mt Shasta Cal.
- Poliaspis pini* *Mask.*² on *Abies firma*; Tokyo, Japan
- Aulacaspis rosae* *Bouché*² on wild rose; Palo Alto Cal.
- A. pentagona* *Targ.*² on cherry, plum; Tokyo, Japan
- A. crawii* *Ckll.*² on Yumi; Tokyo, Japan
- Epidiaspis pyricola* *Del Guér.*³ on prune; Miliken, Santa Clara co. Cal.
- Diaspis bromeliae* *Kern.*² on palm; San José Cal.
- Chionaspis spartinae* *Comst.*² on *Spartina stricta*; Palo Alto Cal.
- C. salicis-nigrae* *Walsh*⁷ on *Salix cordata*; Columbus O.
- C. quercus* *Comst.*³ on *Quercus chrysolepis*; Stevens creek, Mountain View Cal.
- C. pinifoliae* *Fitch*³ on *Torreya californica*; Stevens creek, Mountain View Cal.
- C. ortholobis* *Comst.*³ on dogwood; Mountain View Cal.
- C. gleditsiae* *Sand.*⁷ on *Gleditsia tricanthos*; Columbus O.
- C. americana* *Johus.*⁷ on *Ulmus americana*; Columbus O.
- Aclerda tokionis* *Ckll.*²; Tokyo, Japan
- A. californica* *Ehrh.*² on bunch grass; Mountain View Cal.
- Physokermes insignicola* *Craw.*² on *Pinus radiata*; San Mateo Cal.
- Saissetia oleae* *Bern.*^{2,3} on vine; San Mateo Cal.
- Enlecanium quercitronis kermoides* *Tyr.*³ on *Quercus agrifolia*; Mountain View Cal.
- E. armeniacum* *Craw.*² on prune; Stanford University Cal.
- E. adenostomae* *Kuw.*² on *Adenostoma fasciculatum*; Black Mt Cal.
- Coccus hesperidum* *Linna.*^{2,3} on rose; Arcada Cal.
- Eucalymnatus tessellatus* *Sign.*² on fern; San Francisco Cal.
- Ceroplastes ceriferus* *And.*² on tea
- Pulvinaria rhois* *Ehrh.*³ on *Rhus diversiloba*; near Mountain View Cal.
- P. aurantii* *Ckll.*² on tea; Kokura, Kiushiu, Japan
- Pseudococcus pseudonipae* *Ckll.*² on palm; San Francisco Cal.
- Phenacoccus dubia*² on *Diospyros kaki*; Kusatsu, Shiga-Ken, Japan
- Dactylopius dudleyi* *Cole.*² on *Cupressus macnabiana*; Shasta Cal.
- D. sp.* *Cog.*² on cypress; Del Monte Cal.
- Eriococcus graminis* *Mask.*² on bamboo; Gifu-Ken, Japan.
- E. artemisiae* *Kuw.*³ on *Artemisia californica*; Santa Clara county Cal.
- E. araucariae* *Mask.*² on *Araucaria excelsa*; Berkley Cal.
- E. adenostomae* *Ehrh.*² on *Adenostoma fasciculatum*; Black Mt Cal.
- Gossyparia spuria* *Modecr.*² on elm; Stanford University Cal.
- Cerococcus quercus* *Comst.*² on oak; Mountain View Cal.
- C. ehrhorni* *Ckll.*^{2,3} on live oak; Mountain View Cal.
- Lecaniodiaspis quercus* *Ckll.*² on oak
- Asterolecanium quercicola* *Bouché*² on *Quercus lobata*, Stanford University Cal.
- Icerya purchasi* *Mask.*² on Scotch broom; Stanford University Cal.

Orthoptera

<i>Hypochlora alba</i> Dodge ¹	<i>M. flavidus</i> Scud. ¹
<i>Campylacantha olivaceae</i> Scud. ¹	<i>M. flabellatus</i> Scud. ¹
<i>Hesperottetix viridis</i> Thos. ¹	<i>M. packardii</i> Scud. ¹
<i>H. pratensis</i> Scud. ¹	<i>M. minor</i> Scud. ¹
<i>H. speciosus</i> Scud. ¹	<i>M. luridus</i> Dodge ¹
<i>Aeoloplus regalis</i> Dodge ¹	<i>M. bivittatus</i> Say ¹
<i>Podisma dodgei</i> Thos. ¹	<i>Phoetaliotes nebrascensis</i> (nebrascensis) Thom. ¹
<i>Melanoplus lakinus</i> Scud. ¹	<i>P. nebrascensis</i> (volueris) Dodge ¹
<i>M. differentialis</i> Thos. ⁶	<i>Schistocerca americana</i> Drury ⁶
<i>M. flabellifer</i> Scud. ¹	
<i>M. bowditchi</i> Scud. ¹	

Plecoptera

<i>Perla ephyre</i> Newm. ⁴	<i>P. xanthenes</i> Say ⁴
<i>P. lurida</i> Hag. ⁴	

EXCHANGE LIST

The following is a partial list of the species of insects in the New York State Museum which are available for exchange purposes. In return we are specially desirous, as above stated, of securing specimens of economic importance in different sections of this country and of foreign countries, and particularly of forms likely to become destructive if established in this State.

Hymenoptera

<i>Bombus fervidus</i> Fabr.	<i>Apanteles congregatus</i> Say
<i>B. ternarius</i> Say	<i>Lampronota americana</i> Cress.
<i>B. terricola</i> Kirby	<i>Pimpla conquisitor</i> Say
<i>B. vagans</i> Smith	<i>P. inquisitor</i> Say
<i>Xylocopa virginica</i> Drury	<i>Theronia fulvescens</i> Cress.
<i>Megachile latimanus</i> Say	<i>Ephialtes irritator</i> Fabr.
<i>Andrena vicina</i> Smith	<i>Thalessa lunator</i> Fabr.
<i>Vespa arenaria</i> Fabr.	<i>Paniscus geminatus</i> Say
<i>V. consobrinus</i> Sauss.	<i>Anomalus exile</i> Prov.
<i>V. diabolica</i> Sauss.	<i>Ichneumon centrator</i> Say
<i>V. maculata</i> L.	<i>I. cincticornis</i> Cress.
<i>Polistes pallipes</i> St. Farg.	<i>I. confirmatus</i> Cress.
<i>Odynerus capra</i> Sauss.	<i>I. scelestus</i> Cress.
<i>Philanthus solivagus</i> Say	<i>I. unifasciatus</i> Say
<i>Monedula ventralis</i> Say	<i>I. laetus</i> Brullé
<i>Bembex fasciata</i> Fabr.	<i>Tremex columba</i> Linn.
<i>Chalybion caeruleum</i> Linn.	<i>Allantus basillaris</i> Say
<i>Pelopoeus cementarius</i> Drury	<i>Dolerus arvensis</i> Say
<i>Ammophila communis</i> Cress.	<i>D. sericeus</i> Say
<i>Aporus biguttatus</i> Fabr.	<i>Lygaenematus erichsonii</i> Hartig
<i>A. marginatus</i> Say	<i>Trichicampus viminalis</i> Fallen
<i>Pelecinus polyturator</i> Drury	<i>Cimbex americana</i> Leach

Coleoptera

- Cratoparis lunatus Fabr.*
Tomicus calligraphus Germ.
T. cacographus Lec.
T. pini Say
T. balsameus Lec.
Xyleborus celsus Eich.
X. dispar Fabr.
Cossonus platalea Say
Calandra granaria Linn.
Balaninus nasiceus Say
Mononychus vulpeculus Fabr.
Cryptorhynchus lapathi Linn.
Conotrachelus nenuphar Hbst.
Gymnetron teter Fabr.
Tachypterus quadrigibbus Say
Magdalis armicollis Say
M. barbata Say
M. perforata Horn
Lixus concavus Say
Hylobius pales Hbst.
Pissodes strobi Peck
Phytonomus nigrirostris Fabr.
P. punctatus Fabr.
Cyphomimus dorsalis Horn
Pandeletejus hilaris Hbst.
Otiorhynchus ovatus Linn.
Rhynchites bicolor Fabr.
Epicauta vittata Fabr.
E. cinerea Forst.
E. pennsylvanica DeG.
Macrobasis unicolor Kirby
Henous confertus Say
Meloe angusticollis Say
Notoxus anchora Hentz.
N. bifasciatus Lec.
Mordella marginata Melsh.
Anaspis flavipennis Hald.
Nacerdes melanura Linn.
Pytho americanus Kirby
Melandrya striata Say
Cistela sericea Say
Boletotherus bifurcus Fabr.
Hoplocephala bicornis Oliv.
Diaperis hydni Fabr.
Paratenetus punctatus Sol.
Tribolium ferrugineum Fabr.
Tenebrio tenebrioides Beauv.
T. molitor Linn.
Xylopinus saperdioides Oliv.
- Scotobates calcaratus Fabr.*
Merinus laevis Oliv.
Iphthimus opacus Lec.
Nyctobates pennsylvanica DeG.
Eleodes tricostata Say
Bruchus obtectus Say
Chelymorpha argus Licht.
Coptocycla aurichalcea Fabr.
Odontota rubra Web.
Microrhopala vittata Fabr.
Dibolia borealis Chev.
Phyllotreta sinuata Steph.
Systema hudsonias Forst.
S. frontalis Fabr.
S. bitaeniata Lec.
Crepidodera rufipes Linn.
C. helxines Linn.
C. cucumeris Harr.
Haltica bimarginata Say
Disonychia alternata Ill.
D. pennsylvanica Ill.
D. collaris Fabr.
Galerucella decora Say
G. luteola Müll.
Trirhabda canadensis Kirby
Diabrotica 12-punctata Oliv.
D. vittata Fabr.
Cerotoma caminea Fabr.
Lina scripta Fabr.
Gastroidea polygoni Linn.
Chrysomela similis Rog.
C. elegans Oliv.
C. bigsbyana Kirby
Doryphora clivicollis Kirby
D. 10-lineata Say
Prasocuris varipes Lec.
Nodonota brunnea Fabr.
N. tristis Oliv.
Graphops pubescens Melsh.
Metachroma marginalis Cr.
Typophorus aterrima Oliv.
Chrysochus auratus Fabr.
Glyptoscelis pubescens Fabr.
Fidia viticida Walsh
Xanthonia 10-notata Say
Monachus saponatus Fabr.
Chlamys plicata Fabr.
Babia 4-guttata Oliv.
Crioceris asparagi Linn.

- C. 12-punctata Linn.*
Lema trilineata Oliv.
Syneta ferruginea Germ.
Orsodachna atra Ahr.
Donacia cincticornis Newm.
D. rufa Say
Tetraopes tetraophthalmus Forst.
Saperda tridentata Oliv.
Liopus alpha Say
Monohammus maculosus Hald.
M. scutellatus Say
M. confusor Kirby
Leptura lineola Say
L. exigua Newm.
L. cordifera Oliv.
L. canadensis Fabr.
L. rubrica Say
L. vagans Oliv.
L. proxima Say
L. vittata Germ.
Typocerus velutinus Oliv.
Strangalia acuminata Oliv.
Rhagium lineatum Oliv.
Desmocerus palliatus Forst.
Eudermes picipes Fabr.
Clytanthus ruricola Oliv.
Neoclytus erythrocephalus Fabr.
Xylotrechus colonus Fabr.
Cyllene robiniae Forst.
Molorchus bimaculatus Say
Elaphidion villosum Fabr.
Callidium antennatum Newm.
Prionus laticollis Drury
Orthosoma brunneum Forst.
Parandra brunnea Fabr.
Trichius affinis Gory
Osmoderma scabra Beauv.
O. eremicola Knoch.
Euphoria inda Linn.
Chalepus trachypygus Burm.
Pelidnota punctata Linn.
Strigoderma arboricola Fabr.
Anomala lucicola Fabr.
Lachnosterna fusca Froh.
L. tristis Fabr.
Macroductylus subspinosus Fabr.
Serica trociformis Burm.
Dichelonychia elongata Fabr.
D. albicollis Burm.
Hoplia modesta Hald.
Geotrupes splendidus Fabr.
Bolboceras faretus Fabr.
Aphodius fossor Linn.
A. fimetarius Linn.
A. granarius Linn.
A. inquinatus Hbst.
Onthophagus pennsylvanicus Harold
O. hecate Panz.
Phanaeus carnifex Linn.
Copris anaglypticus Say
Canthon laevis Drury
Passalus cornutus Fabr.
Ceruchus piceus Web.
Dorcus parallelus Say
Ennearthron thoracicornis Zeigl.
Lyctus opaculus Lec.
Sitodrepa panicea Linn.
Ptinus quadrimaculatus Melsh.
Clerus quadriguttatus Oliv.
C. nigriventris Lec.
C. analis Lec.
Trichodes nuttali Kirby
Telephorus carolinus Fabr.
T. scitulus Say
T. rotundicollis Say
T. bilineatus Say
Podabrus rugulosus Lec.
Chauliognathus pennsylvanicus DeG.
C. marginatus Fabr.
Photuris pennsylvanicus DeG.
Photinus scintillans Say
Pyropyga nigricans Say
Ellychnia corrusca Linn.
Lucidota atra Fabr.
Calopteron reticulatum Fabr.
Brachys ovata Web.
Agrilus anxius Gory
A. ruficollis Fabr.
Acmeodera pulchella Hbst.
Chrysobothris femorata Fabr.
C. floricola Gory
C. dentipes Germ.
C. scabripennis Lap. & Gory
C. pusilla Lap. & Gory.
Buprestis maculiventris Say
Dicerea divaricata Say
Chalcophora virginienensis Drury
Asaphes decoloratus Say
Oxygonus obesus Say
Corymbites inflatus Say

C. cylindriciformis *Hbst.*
Limonius confusus *Lec.*
Melanotus communis *Gyll.*
Dolopius lateralis *Esch.*
Elatér nigricollis *Hbst.*
E. obliquus *Say*
Cryptohypnus planatus *Lec.*
Alaus oculatus *Linn.*
Tharops ruficornis *Say*
Tenebrioides corticalis *Melsh.*
Ips quadriguttatus *Fabr.*
Omosita colon *Linn.*
Nitidula bipustulata *Linn.*
Conotelus obscurus *Er.*
Colastus truncatus *Rand.*
Hister parallelus *Say*
Anthrenus scrophulariae *Linn.*
A. verbasci *Linn.*
Attagenus piceus *Oliv.*
Dermestes lardarius *Linn.*
Byturus unicolor *Say*
Triphyllus humeralis *Kirby*
Mycetophagus punctatus *Say*
M. flexuosus *Say*
Silvanus surinamensis *Linn.*
Tritona thoracica *Say*
T. humeralis *Fabr.*
Lycoperdina ferruginea *Lec.*
Epilachna borealis *Fabr.*
Brachyacantha ursina *Fabr.*
Chilocorus bivulnerus *Muls.*
Psyllobora 20-maculata *Say*
Anatis ocellata *Linn.*
Adalia bipunctata *Linn.*
Coccinella trifasciata *Linn.*
C. 9-notata *Hbst.*
C. transversalis *Muls.*
C. sanguinea *Linn.*
Hippodamia 13-punctata *Linn.*
H. parenthesis *Say*
Megilla maculata *DeG.*
Tachinus fimbriatus *Grav.*
Stenus flavicornis *Er.*
Paederus littorarius *Grav.*
Philonthus aeneus *Rossi*
Staphylinus cinnamopterus *Grav.*
S. maculosus *Grav.*
Crepophilus villosus *Grav.*
Listrotrophus cingulatus *Grav.*
Silpha surinamensis *Fabr.*

S. lapponica *Hbst.*
S. inaequalis *Fabr.*
S. noveboracensis *Forst.*
S. americana *Linn.*
Necrophorus marginatus *Fabr.*
N. pustulatus *Hersch.*
N. tomentosus *Web.*
Sphaeridium scarabaeoides *Linn.*
Hydrobius fuscipes *Linn.*
H. globosus *Say*
Hydrocharis obtusatus *Say*
Hydrophilus triangularis *Say*
H. glaber *Hbst.*
Dinentes assimilis *Aube*
Gyrinus ventralis *Kirby*
G. picipes *Aube*
Aeilus semisulcatus *Aube*
Dytiscus fasciventris *Say*
Colymbetes sculptilis *Harr.*
Agabus punctulatus *Aube*
Ilybius biguttatus *Germ.*
Deronectes griseostriatus *DeG.*
Laccophilus maculosus *Germ.*
Cnemidotus 12-punctatus *Say*
Anisodactylus rusticus *Say*
A. discoideus *Dej.*
A. interstitialis *Say*
Bradycellus rupestris *Say*
Harpalus erraticus *Say*
H. viridiaceus *Beauv.*
H. caliginosus *Fabr.*
H. pennsylvanicus *DeG.*
H. herbivagus *Say*
Agonoderus pallipes *Fabr.*
Chlaenius sericeus *Forst.*
C. tricolor *Dej.*
C. pennsylvanicus *Say*
C. tomentosus *Say*
Lebia grandis *Hentz*
L. viridis *Say*
Galerita janus *Fabr.*
Calathus gregarius *Say*
Dicaelus elongatus *Bon.*
Amara impuncticollis *Say*
Pterostichus stygius *Say*
P. lucublandus *Say*
P. corvinus *Dej.*
P. patricius *Dej.*
P. femoralis *Kirby*
Tachys nanus *Gyll.*

Bembidium quadrimaculatum Linn.
Scarites subterraneus Fabr.
Pasimachus elongatus Lec.
Nebria sahlbergi Fisch.
Elaphrus ruscarius Say
Calosoma calidum Fabr.
Carabus vinetus Web.
Omophron americanum Dej.

Cicindela lecontei Hald.
C. sexguttata Fabr.
C. generosa Dej.
C. vulgaris Say
C. repanda Dej.
C. purpurea Oliv.
C. 12-guttata Dej.
C. punctulata Fabr.

Diptera

Physocephala fureillata Will.
Drosophila ampelophila Loew.
Chloropisca variceps Loew.
Piophilus casei Linn.
Lauxania flaviceps Loew.
Trypeta longipennis Wied.
Rhagoletis cingulata Loew.
Phorbia fusciceps Rondani
Pollenia rudis Fabr.
Belvoisia unifasciata Desv.
Ocyptera carolinae Desv.
Tachina mella Walk.
Echinomyia algens Wied.
Gonia capitata DeG.
Archytas analis Fabr.
Spilomyia fusca Loew.
Syrirta pipiens Linn.
Helophilus similis Macq.
Eristalis dimidiatus Wied.

E. tenax Linn.
E. transversus Wied.
Rhingia nasica Say
Sphaerophoria cylindrica Say
Mesograpta marginata Say
Syrphus lesueurii Macq.
S. ribesii Linn.
S. americanus Wied.
Platycheirus quadratus Say
Tabanus atrata Fabr.
T. reinwardtii Wied.
T. lineola Fabr.
Therioptectes microcephalus O. S.
Chrysops vittatus Wied.
C. excitans Walk.
C. niger Macq.
Pangonia tranquilla O. S.
Bibio albipennis Linn.

Lepidoptera

Papilio glaucus turnus Linn.
Pontia rapae Linn.
Eurymus philodice Godt.
Argynnis aphrodite Fabr.
A. atlantis Edw.
Brenthis myrina Cram.
B. bellona Fabr.
Phyciodes tharos Dru.
Eugonia j-album Boisd.
Euvanessa antiopa Linn.
Vanessa atalanta Linn.
Basilarchia arthemis Dru.
B. archippus Cram.
Anosia plexippus Linn.
Fenisecca tarquinus Fabr.
Heodes hypophleas Boisd.
Samia cecropia Linn.
Callosamia promethia Dru.
Lycomorpha pholus Dru.

Ctenucha virginica Charp.
Eubaphe aurantiaca Hub.
Haploa confusa Lyman
Estigmene acraea Dru.
Isia isabella Sm. & Abb.
Diacrisia virginica Fabr.
Apantes virgo Linn.
A. parthenice Stretch.
Halisidota tessellaris Sm. & Abb.
H. caryae Harr.
Alypia octomaculata Fabr.
Hadena passer Guen.
H. dubitans Walk.
H. devastatrix Bracc.
H. arctica Boisd.
Pyrophila pyramidoides Guen.
Adelphagrotis prasina Fabr.
Peridroma margaritosa Harr.
Noctua smithii Snell.

N. bicarnea *Guen.*
N. c-nigrum *Linn.*
N. clandestina *Harr.*
Feltia subgothica *Haw.*
F. jaculifera *Guen.*
Paragrotis redimicula *Morr.*
Mamestra purpurissata *Grote*
M. meditata *Grote*
M. renigera *Steph.*
M. olivacea *Morr.*
Nephelodes minians *Guen.*
Heliophila unipuncta *Haw.*
H. luteopallens *Smith*
Tricholita signata *Streck.*
Gortyna nictitans *Bork.*
Orthosia helva *Grote*
Plusia aerea *Hübner.*
P. aeroides *Grote*

Autographa bimaculata *Steph.*
A. precatonensis *Guen.*
A. brassicae *Riley*
A. rectangula *Kirby*
A. u-aureum *Guen.*
A. falcigera *Kirby*
Eustrotia carneola *Guen.*
Notolophus badia *Hy. Edw.*
Hemerocampa leucostigma *Abb. & Sm.*
Eudule mendica *Walk.*
Cingilia catenaria *Dru.*
Sabulodes transversata *Dru.*
Sesia tipuliformis *Clerck.*
Desmia funeralis *Hübner.*
Evergestis straminealis *Hübner.*
Tholera reversalis *Guen.*

Trichoptera

Leptocerus resurgens *Walk.*
Hydropsyche scalaris *Hag.*
Iialesus guttifer *Walk.*

Goniotaenius dispectus *Walk.*
Neuronia postica *Walk.*

Mecoptera

Panorpa rufescens *Rambur*
P. maculosa *Hag.*

Bittacus strigosus *Hag.*

Neuroptera

Polystoechotes punctatus *Fabr.*

Corydalis cornuta *Linn.*

Hemiptera

Canthophorus cinctus *Beauv.*
Podisus maculiventris *Say*
P. placidus *Uhler*
Brochymena 4-pustulata *Fabr.*
Cosmopepla carnifex *Fabr.*
Euschistus servus *Say*
E. tristigmus *Say*
E. fissilis *Uhler*
E. variolarius *P. B.*
Coenus delius *Say*
Pentatoma juniperana *Linn.*
Murgantia histrionica *Hahn.*
Nezara hilaris *Say*
Anasa tristis *DeG.*
Alydus eurinus *Say*
Leptocoris trivittatus *Say*
Blissus leucopterus *Say*

Lygaeus turcicus *Fabr.*
Leptopterna dolabrata *Linn.*
Calocoris rapidus *Say*
Lygus pratensis *Linn.*
Poecilopsus lineatus *Fabr.*
Capsus ater *Linn.*
Piesma cinerea *Say*
Corythuca arcuata *Say*
Phymata wolffii *Her. Sch.*
Nabis rufusculus *Reut.*
Acholla multispinosa *DeG.*
Limnotrechus marginatus *Say*
Belostoma americana *Leid.*
Notonecta undulata *Say*
Cicada tibicen *Linn.*
C. septendecim *Linn.*
Publilia concava *Say*

P. bicinctus Godg.
Ceresa bubalus Fabr.
C. diceros Say
Stictocephala inermis Fabr.
Smilia camelus Fabr.
Telamona ampelopsidis Harr.
Enchenopa binotata Say
Ormenis pruinosa Say
Aphrophora saratogensis Fitch

A. quadrangularis Say
Clastoptera proteus Fitch
Diedrocephala mollipes Say
D. coccinea Forst.
D. noveboracensis Fitch
Helochara communis Fitch
Thamnotettix clitellarius Say
Empoasca rosae Harr.
Trioza tripunctata Fitch

Coccidae

Lepidosaphes ulmi Linn.
Aspidiotus perniciosus Comst.
A. ostreaeformis Curt.
A. ancylus Putn.
A. abietis Schr.
Aulacaspis rosae Bouché
Diaspis boisduvalii Sign.

Chionaspis furfura Fitch
C. euonymi Comst.
C. americana Johns.
Eulecanium nigrofasciatum Perg.
Pulvinaria innumerabilis Rathv.
Gossyparia spuria Modecr
Kermes galliformis Riley

CONTRIBUTIONS TO COLLECTION OCT. 16, 1902-OCT. 15, 1903

Hymenoptera

Bombus vagans Smith, adult, July 24, C. R. Pettis, Saranac Inn N.Y.
Melissodes sphaeralceae Ckll., adult, Sep. 10, T. D. A. Cockerell, Pecos N.M.

Megachile cleomi? Ckll., adult, Sep. 10, T. D. A. Cockerell, Pecos N.M.

M. sapelloni? Ckll., adult, Sep. 10, T. D. A. Cockerell, Pecos N.M.

M. monardarum Ckll., adult, Sep. 10, T. D. A. Cockerell, Pecos N.M.

Perdita stotteri Ckll., adult, Sep. 10, T. D. A. Cockerell, Pecos N.M.

Camponotus herculeanus Linn., adult, May 21, F. R. Calkins, Ossining N.Y.

C. var. pennsylvanicus DeG. large black ant, work on balsam, Oct. 31, Jonas H. Brooks, Albany N.Y.

Pteromalus puparum Linn., adult, from *Eu Vanessa antiopa* Linn., Feb. 8, J. H. Cook, Albany N.Y.

Biorhiza forticornis Walsh, oak fig gall on oak, Aug. 24, C. H. Peck, Albany N.Y.

Urocetus tricolor Prov., adult, July 18, James Roy & Co., Troy N.Y.

Dolerus arvensis Say, adult, Ap. 30, F. R. Calkins, Ossining N.Y.

Emphytus cinctipes Nort., July 11, C. J. Locke, Ogdensburg N.Y.

Coleoptera

Phytonomus nigrirostris Fabr., adult, on clover, Mar. 25, F. R. Calkins, Ossining N.Y.

Mycetochares binotata Say, adult, July 11, C. J. Locke, Ogdensburg N.Y.

Spermophagus robiniae Sch., adult, June 6, **Reinlein Gasoline Torch Co.**, Mt Vernon Ill.

Chelymorpha argus Licht., argus beetle, adult, June 6, **C. J. Locke**, Ogdensburg N.Y.

Coptocycla bicolor Fabr., golden tortoise beetle, adult on peach leaves, May 30, **Emma S. Thomas**, Schoharie N.Y. Same, adult, June 6, **C. J. Locke**, Ogdensburg N.Y.

Galerucella luteola Müll., elm leaf beetle, adult on elm, May 25, **F. R. Calkins**, Ossining N.Y. Same, eggs and larvae on elm, July 13, **F. R. Calkins**, Ossining N.Y.

Diabrotica vittata Fabr., adult on squash, May 25, **F. R. Calkins**, Ossining N.Y.

Chrysomela bigsbyana Kirby, adult, June 25, **C. J. Locke**, Ogdensburg N.Y.

Doryphora clivicollis Kirby, adult, July 11, **C. J. Locke**, Ogdensburg N.Y.

Chrysochus auratus Fabr., golden gilt beetle, adults on dogbane, July 16, **J. Jay Barden**, Dansville N.Y. Same, adult, July 24, **C. R. Pettis**, Saranac Inn N.Y.

Diabrotica vittata Fabr., striped cucumber beetle, adult, June 25, **C. J. Locke**, Ogdensburg N.Y.

Crioceris 12-punctata Linn., 12-spotted asparagus beetle, adult, June 3, **C. H. Peck**, Menands N.Y.

C. asparagi Linn., asparagus beetle, adult on asparagus, May 25, **C. L. Williams**, Glens Falls N.Y. Same, adult on asparagus Sep. 3, **W. F. Greene**, Mt Vernon N.Y.

Tetraopes tetraophthalmus Forst., adult, July 11, **C. J. Locke**, Ogdensburg N.Y.

Oberca bimaculata Oliv., raspberry cane girdler work on raspberry canes, June 24, **John U. Metz**, Swornville N.Y.

Centrodera decolorata Harr., adult on butternut, Jan. 5, **G. S. Graves**, Newport N.Y.

Desmocerus palliatus Forst., adult, June 25, **C. J. Locke**, Ogdensburg N.Y.

Cyllene robiniae Forst., locust borer, Oct. 18, **W. C. Hitchcock**, Pittstown N.Y. Same, larvae on locust, June 16, **M. T. Richardson**, Brooklyn N.Y.

Prionus laticollis Drury, broad-necked *Prionus*, adult, July 20, **Miss M. J. Tyers**, Dobbs Ferry N.Y.

Ligyrus gibbosus DeG. adult, June 6, **Reinlein Gasoline Torch Co.**, Mt Vernon Ill.

Pelidnota punctata Linn., spotted grapevine beetle, Oct. 18, **W. C. Hitchcock**, Pittstown N.Y.

Lachnosterna fusca Fröhl., larva, June 25, **C. J. Locke**, Ogdensburg N.Y.

Diplofaxis liberta Germ., adults on peach, Sep. 24, **J. R. Crandall**, Hauppauge N.Y.

Macroductylus subspinosus Fabr., rose beetle, adult on fruit trees, June 16, **H. A. Jordan**, Cossackie N.Y.

Dichelonycha elongata Fabr., adult, June 6, **C. J. Locke**, Ogdensburg N.Y.

Lyctus parallelopipedus Melsh., adults in ash, July 10, **Joseph P. McHugh & Co.**, New York.

Collops vittatus Say, adult, July 24, **C. R. Pettis**, Saranac Inn N.Y.

Telephorus carolinus Fabr., adult, June 25, **C. J. Locke**, Ogdensburg N.Y.

Podabrus rugulosus Lec., adult, June 25, **C. J. Locke**, Ogdensburg N.Y. Same, adult, July 11, **C. J. Locke**, Ogdensburg N.Y.

Lampyrid, larva, June 12, **George S. Graves**, Newport N.Y.

Chalcophora virginienensis Drury, adults, Oct. 18, **W. C. Hitchcock**, Pittstown N.Y.

Melanotus communis Gyll., adult, July 11, **C. J. Locke**, Ogdensburg N.Y.

Dolopius lateralis Esch., adult, July 11, **C. J. Locke**, Ogdensburg N.Y.

Alaus oculatus Linn., owl beetle, adult, July 9, **C. L. Daggett**, Albany N.Y. Same, adults, July 27, **Fred G. Carnes**, W. Chazy N.Y.

Anthrenus verbasci Linn., adult, May 25, **F. R. Calkins**, Ossining N.Y.

Chilocorus bivulnerus Muls., twice-stabbed ladybeetle, adult (feeding on San José scale) June 13, **Mr Hotchkin**, Binghamton N.Y.

Adalia bipunctata Linn., two-spotted lady beetle, adult, July 31, **George S. Graves**, Newport N.Y. Same on Norway maple, June 12, **M. F. Tiger**, Patchogue N.Y. Same, larvae on rose, June 3, **Mrs A. G. Dana**, Far Rockaway N.Y.

Coccinella transversalis Muls., adult, July 24, **C. R. Pettis**, Saranac Inn N.Y.

C. 9-notata Herbst, adult, July 24, **C. R. Pettis**, Saranac Inn N.Y.

Hydrophilus triangularis Say, adult, June 16, **Frances McCarty**, Albany N.Y.

Harpalus erraticus Say, adult, July 24, **C. R. Pettis**, Saranac Inn N.Y.

Agonoderus pallipes Fabr., adult, May 21, **F. R. Calkins**, Ossining N.Y.

Pterostichus lucublandus Say, adult, July 24, **C. R. Pettis**, Saranac Inn N.Y.

Cicindela punctulata Fabr., adult, July 6, **Richard Lohrmann**, Herkimer N.Y.

C. repanda Dej., adult, June 25, **C. J. Locke**, Ogdensburg N.Y.

C. vulgaris Say, adult, July 24, **C. R. Pettis**, Saranac Inn N.Y.

C. generosa Dej., adult, July 6, **Richard Lohrmann**, Herkimer N.Y.

C. 6-guttata Fabr., adult, June 25, **C. J. Locke**, Ogdensburg N.Y.

Siphonaptera

Ceratopsyllus serraticeps, cat flea, adult, infesting house, Sep. 14, **Otis Arnold**, Albany N.Y.

Diptera

Mosquito, larvae and adults, July 11, **C. J. Locke**, Ogdensburg N.Y.

Psorophora ciliata Fabr., adult, Aug. 6, **H. C. Weeks**, Sheepshead Bay, Brooklyn N.Y.

Chironomids, adult, Ap. 30, **F. R. Calkins**, Ossining N.Y.

- Lasioptera vitis*? O. S., June 4, **Francesco Landini**, New York.
- Therioptetes affinis* adult, July 24, **C. R. Pettis**, Saranac Inn N.Y.
- Tabanus atratus* Fabr., mourning horsefly, adult, July 7, **Abraham Knechtel**, Albany N.Y.
- Syrphus ribesii* Linn., adult, Ap. 30, **F. R. Calkins**, Ossining N.Y.
- Stratiomyid, adult, May 25, **C. L. Williams**, Glens Falls N.Y.
- Tachinid sp., puparium infesting stalk borer, July 15, **C. L. Williams**, Glens Falls N.Y.
- Pollenia rudis* Fabr., cluster fly, adults in house, Sep. 1, **K. B. Christman**, Burtonville N.Y.
- Phorbia brassicae* Bouché, cabbage root maggot, larvae in turnips, Nov. 18, **J. J. Cormot**, Phoenix R.I.
- P. ceparum* Meigen, onion maggot, grubs on onions, June 19, **Mr VanDerzee**, Kenwood N.Y. Same, Mar. 25, **F. R. Calkins**, Ossining N.Y.
- Trypeta longipennis* Weid., adult, on *Helianthus*, July 31, **George S. Graves**, Newport N.Y.

Lepidoptera

- Papilio polyxenes* Fabr., adult, Feb. 11, **R. K. Colville**, Kenwood N.Y. Same, larva, June 16, **Mrs Humphrey**, Watervliet N.Y.
- Pieris oleracea* Harr., cabbage butterfly, adult, July 14, **Carl Heiser**, Malone N.Y.
- Basilarchia arthemis* Dr. banded purple, adult, June 17, **Mrs A. M. A. Jackson**, Camillus N.Y.
- Sphecodina abbotii* Swains, Oct. 18, **W. C. Hitchcock**, Pittstown N.Y.
- Samia cecropia* Linn., cecropia moth, adult eggs, June 12, **A. Saunders**, Ridge road, Irondequoit N.Y.
- Telea polyphemus* Cramer, egg and cocoon, June 6, **C. J. Locke**, Ogdensburg N.Y.
- Ctenucha virginica* Charp., adult, June 25, **C. J. Locke**, Ogdensburg N.Y.
- Estigmene aceræa* Dr. salt marsh caterpillar, adult, June 9, **George S. Graves**, Newport N.Y.
- Alypia octomaculata* Fabr., 8-spotted forester, larvae on virginia creeper, July 26, **Percy MacG. Allen**, Albany N.Y.
- Noctua clandestina* Harr., adult, June 25, **C. J. Locke**, Ogdensburg N.Y.
- Feltia subgothica*? Haworth, larva on cabbage, June 25, **C. J. Locke**, Ogdensburg N.Y.
- Mamestra picta* Harr., zebra caterpillar, larva on strawberry, June 9, **C. L. Williams**, Glens Falls N.Y.
- Heliophila pseudargyria* Guenée, adults, May 21, **F. R. Calkins**, Ossining N.Y.
- Xylina laticinerea*? Grote, larva on peach, May 28, **Henry G. Parsons**, Milton N.Y.
- Heliothis Armiger* Hübn., corn worm, larva on corn, Aug. 25, **Dr M. W. VanDenburg**, Mt Vernon N.Y.
- Heterocampa bilineata* Pack., larvae on beech, July 12, **E. H. Mairs**, Irvington N.Y.

Notolophus antiqua Linn., larva, June 25, **C. J. Locke**, Ogdensburg N.Y.

Tolyte velleda? Stoll, lappet moth, larva on apple, June 13, **Mr Hotchkin**, Binghamton N.Y.

Hydria undulata Linn., on cherry, Aug. 15, **C. R. Pettis**, Saranac Inn N.Y.

Prionoxystus ? *robiniae* Peck, larvae on beech. Jan. 5, **George S. Graves**, Newport N.Y.

Sanninoidea exitiosa Say, Oct. 18, **W. C. Hitchcock**, Pittstown N.Y.

Sesia acerni Clem., maple sesian, larva on maple, Sep. 18 **W. C. H.**, Hartley Hall Pa.

Evergestis straminealis Hübn., black headed cabbage worm, larvae on turnip, July 22, **George S. Graves**, Newport N.Y.

Hypsopygia costalis Fabr., clover hay worm, larvae, Mar. 16, **J. Mace Smith**, Ithaca N.Y.

Archips rosaceana Harr., adult, June 6, **Reinlein Gasoline Torch Co.**, Mt Vernon N.Y. Same, July 11, **C. J. Locke**, Ogdensburg N.Y. Same, larva on rose, June 25, **C. J. Locke**, Ogdensburg N.Y.

Gelechia aceriella Clem., larva on maple, Aug. 27, **George S. Graves**, Newport N.Y.

Bucculatrix pomifoliella Clem., apple leaf *Bucculatrix*, cocoons on apple, Nov. 17, **L. L. Woodford**, Berwyn N.Y.

Tineola biselliella Hummel, clothes moth, larva in a mattress, June 25, **Mrs P. N. Nicholas**, Geneva N.Y.

Neuroptera

Psocus venosus Burm., on maple, Aug. 12, **George S. Graves**, Newport N.Y.

Sialis infumata Newm., alder fly, June 6, **C. J. Locke**, Ogdensburg N.Y.

Trichoptera

Mystacides nigra Linn., July 11, **C. J. Locke**, Ogdensburg N.Y.

Plecoptera

Taeniopteryx fasciata Burm., Mar. 25, **F. R. Calkins**, Ossining N.Y.

Pteronarcys regalis Newm., adult, June 6, **C. J. Locke**, Ogdensburg N.Y.

Hemiptera

Canthophorus cinctus Beauv., adult, July 24, **C. R. Pettis**, Saranac Inn N.Y.

? *Nezara hilaris* DeG., nymphs killing asparagus beetle grubs, Sep. 3, **W. F. Greene**, Mt Vernon N.Y.

Leptopterna dolabrata Linn., on wheat, June 15, **J. Jay Barden**, Stanley N.Y. Same, adult, June 25, **C. J. Locke**, Ogdensburg N.Y. Same, July 11, **C. J. Locke**, Ogdensburg N.Y.

Calocoris rapidus Say, adult, June 25, **C. J. Locke**, Ogdensburg N.Y.

Poecillocapsus lineatus Fabr., July 11, **C. J. Locke**, Ogdensburg N.Y.

Capsus ater Linn., adult, June 25, **C. J. Locke**, Ogdensburg N.Y. Same, July 11, **C. J. Locke**, Ogdensburg N.Y.

Acanthia lectularia Linn., bedbug, July 24, **C. R. Pettis**, Saranac Inn N.Y.

Corythuca marmorata Uhler, adults on chrysanthemum, June 1, **Harry Blauvelt**, Coeyman N.Y.

Coriscus subcoleopterus Kirby, adult, July 24, **C. R. Pettis**, Saranac Inn N.Y.

Acholla multispinosa DeG. nymphs on grape, May 25, **F. R. Calkins**, Ossining N.Y.

Cicada tibicen Linn., harvest fly, adult, Aug. 12, **George S. Graves**, Newport N.Y. Same, Aug. 24, **H. B. Taylor**, Albany N.Y.

Ceresa taurina Fitch, tree hopper scars on apple, Ap. 24, **Mr Niles**, Chatham N.Y.

Telemona reclinata? Fitch, July 11, **C. J. Locke**, Ogdensburg N.Y.

Psylla pyricola Riley, pear psylla, all stages on pear, July 26, **Jacob H. Wagar**, Cropseyville N.Y. Same, nymphs on pear, Aug. 17, **Miss M. L. Williams**, Sherburne N.Y. Same, pupa on pear, May 25, **G. F. White**, Preston Hollow N.Y.

Chermes pinicorticis Fitch, pine bark chermes, eggs on white pine, May 2, **C. R. Pettis**, Saranac Inn N.Y.

Pemphigus tessellatus Fitch, larvae and adult on alder, Aug. 29, **C. R. Pettis**, Saranac Inn N.Y.

P. popularius Fitch, adult on poplar *P. balsamifera*, July 24, **C. R. Pettis**, Saranac Inn N.Y.

Hormaphis hamamelidis Fitch, galls on witch hazel, Aug. 12, **George S. Graves**, Newport N.Y.

Schizoneura americana Riley, adults on elm, June 15, **C. J. Locke**, Ogdensburg N.Y.

Lachnus viminalis Fonse., adult, May 25, **F. R. Calkins**, Ossining N.Y.

Drepanosiphum acerifolii Thos., adults on *Acer saccharinum* June 26, **George S. Graves**, Newport N.Y.

Aphis gossypii Glover, adults and larvae on tomato, Aug. 6, **C. H. Peck**, Menands N.Y.

?*Nectarophora tiliae* Monell, basswood louse, eggs on basswood, Nov. 24, **L. L. Woodford**, Berwyn N.Y.

Nectarophora rudbeckiae Fitch, adults on *Rudbeckia laciniata*, June 25, **G. G. Atwood**, Albany N.Y.

Myzus ribis Linn? on *Ribes aureum*, July 8, **W. H. Harrison**, Lebanon Springs N.Y.

M. cerasi Fabr., on cherry, May 25, **F. R. Calkins**, Ossining N.Y. Same, larvae and adult on *Prunus pennsylvanica*, July 24, **C. R. Pettis**, Saranac Inn N.Y.

Rhopalosiphum solani Thos., tomato louse, all stages, on tomato, June 9, **J. M. Dolph**, Port Jervis N.Y.

Callipterus betulaecolens Fitch, birch leaf aphid on cut leaved birch, Aug. 8, **E. P. VanNess**, East Greenbush N.Y.

Lepidosaphes ulmi Linn., appletree bark louse, eggs on lilac. Mar. 17, **T. L. M.**, Staten Island N.Y. Same, adults on willow, May 2, **M. T. Richardson**, New York.

Chrysomphalus tenebricosus Comst., gloomy scale insect, on maple, Dec. 29, **G. W. Herrick**, Vicksburg Miss.

Aspidiotus perniciosus Comst., San José scale, adults and young on apple, Nov. 3, **Edward V. Cox**, New York city. Same, adults and young on peach and plum, Dec. 29, **G. W. Herrick**, Ellisville Miss. Same, adults on Japanese quince, Feb. 23, Albany N.Y. Same, young adults on Japanese quince, May 7, **M. T. Richardson**, New York. Same, adults on apple, May 16, **A. N. Cloud**, Cocksackie N.Y. Same, adults on pear, June 9, **George M. Adams**, Spencerport N.Y.

A. forbesi Johns., cherry scale insect, adults on cherry, Dec. 29, **Glenn W. Herrick**, Meridian Miss.

A. ancylus Putn., Putnam's scale, young on apple (fruit) Nov. 10, **C. H. Darrow**, Geneva N.Y. Same, adult on white birch, Ap. 7, **Prof. C. F. Hodge**, Clark University, Worcester Mass.

Poliaspis carissae Ckll., adults on carissa, Dec. 22, **T. D. A. Cockerell**, East Las Vegas N.M.

Pheucaspis natalensis Ckll., adults on nango, Dec. 12, **T. D. A. Cockerell**, East Las Vegas N.M.

Aulacaspis rosae Bouché, rose scale insect, on blackberry, Nov. 24, **L. L. Woodford**, Berwyn N.Y.

Chionaspis euonymi Comst., euonymus scale, adults on euonymus, Sep. 19, **T. W. Baldwin**, Nyack N.Y.

C. lintneri Comst., adults on cornus, Ap. 27, **H. C. Peck**, Rochester N.Y.

Eulecanium tulipiferae Cook, tuliptree scale insect, adults and young on tulip, Aug. 2, **Mrs W. H. Whitaker**, Flushing N.Y.

E. prunastri? Fonsc., New York plum scale, adults on pear, June 12, **E. L. Mitchell**, Clarksville N.Y.

E. nigrofasciatum Perg., black banded lecanium on peach, May 1, **G. S. Clarke**, Milton N.Y.

E. armeniacum Craw., adults on crimson rambler rose, May 26, **Myron S. Wheeler**, Berlin Mass.

Coccus hesperidum Linn., on begonia, June 6, **C. J. Locke**, Ogdensburg N.Y.

Lecanium sp., adult on trumpet vine, June 10, **C. E. Eldridge**, Leon N.Y.

Pulvinaria innumerabilis Rathv., maple tree scale insect, adult on maple, June 20, **M. T. Tyers**, Dobbs Ferry N.Y.

Halimococcus lampas Ckll., adults on palm, Dec. 22, **T. D. A. Cockerell**, East Las Vegas N.M.

Orthoptera

Ceuthophilus maculatus Say, spotted wingless grasshopper, adult, May 15, **C. E. Wieting**, Cobleskill N.Y.

Thysanura

Achorutes packardi Folsm., adults on peartree bark Ap. 7, **A. W. K. Lick**, Germantown N.Y.

Arachnida

Micrathena sagittata Walck., adult killing asparagus beetles, Sep. 3, **W. F. Greene**, Mt Vernon N.Y.

Ixodes cruciarius Fitch, tick, Ap. 21, **C. H. North**, Dannemora N.Y.

Dermacentor americanus, the dog or wood tick, adult on dog, July 26, **E. N. Huyck**, Rensselaerville N.Y.

Chernes sanborni Hagen, adult on house fly, Sep. 7, **Dr H. E. Smith**, Norwich N.Y.

Trombidium muscarum Riley, adults on house fly, Sep. 7, **Dr H. E. Smith**, Norwich N.Y.

Phytoptus quadripes Shimer, galls on *Acer dasycarpum*, July 3, **G. G. Atwood**, Albany N.Y.

Bryobia pratensis Garm., clover mite, eggs on peach, Nov. 17, **L. L. Woodford**, Berwyn N.Y.

Gamasus sp. adult? May 21, **F. R. Calkins**, Ossining N.Y.

Myriapoda

Scutigera forceps Raf., house centipede, adults in house, Sep. 22, **Chancey Whitmyre**, Schenectady N.Y.

The following is a small collection, except a few species which have not been determined, of insects kindly contributed by Mr J. R. de la Torre Bueno of New York city, who collected the same in that vicinity.

Cossonus platalea Say

Centrinus picumnus Hbst.

C. scutellum-album Say

Madarus undulatus Say

Baris transversa Say

Copturus minutus Lec.

Conotrachelus seniculus Lec.

C. nenuphar Hbst.

Gymnetron teter Fabr.

Anthonomus signatus Say

Otidocephalus chevrolatii Horn

Phytonomus nigrirostris Fabr.

P. punctatus Fabr.

Apion nigrum Hbst.

Sitones flavescens Marsh.

S. hispidulus Germ.

Aphrastus taeniatu Gyll.

Otiobrychus ovatus Linn.

Phyxelis rigidus Say

Attelabus nigripes Lec.

Rhynchites bicolor Fabr.

Eugnamptus collaris Fabr.

Rhipiphorus limbatus Fabr.

Mordellistena aspersa Melsh.

M. comata Lec.

M. trifasciata Say

Mordella marginata Melsh.

Bruchus musculus Say

Cerotoma caminea Fabr.

Trichius affinis Gory.

Ligyris gibbosus DeG.

Chalepus trachypygus Burm.

Anomala lucicola Fabr.

Macroductylus subspinosus Fabr.

Chauliognathus pennsylvanicus DeG.

Photinus consanguineus Lec.

Lucidota atra Fabr.

Calopteron reticulatum Fabr.

Adalia bipunctata Linn.

Coccinella 9-notata Hbst.

Hippodamia glacialis Fabr.

Silpha surinamensis Fabr.

Harpalus caliginosus Fabr.

Casnonia pennsylvanica Linn.

Cicindela punctulata Fabr.

EXPLANATION OF PLATES

PLATE 1

Dorsal view of *Eniscopilus arcuatus* Felt

PLATE 2

Ophionid wings

- 1 *Ophion ferruginipennis* Felt
- 2 *Ophion bifoveolatum* Brullé
- 3 *Ophion bilineatum* Say
- 4 *Eniscopilus appendiculatus* Felt
- 5 *Ophion abnormum* Felt
- 6 *Eremotylus macrurus* Linn.

PLATE 3

Work of *Chrysanthemum* lace-bug, *Corythuca marmorata* Uhler

PLATE 4

Chrysanthemum lace-bug

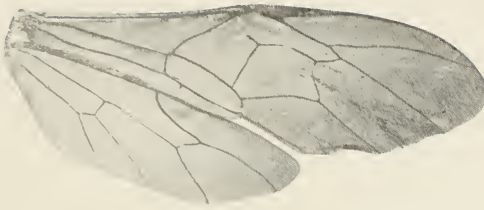
Corythuca marmorata Uhler

- 1 Section of leaf showing insertion of eggs below the surface
- 2 Dorsal spines of stage 1: *a*, arising from cone-shaped base, *b*, directly from the body
- 3 Lateral abdominal spine of stage 1
- 4 Dorsal view of nymph in stage 2
- 5 Dorsal spines of stage 2: *a*, arising from cone-shaped base, *b*, directly from the body
- 6 Lateral abdominal spine of stage 2
- 7 Dorsal spines of stage 3: *a*, arising from cone-shaped base, *b*, directly from the body
- 8 Lateral abdominal spines of stage 3
- 9 Dorsal view of nymph in stage 4
- 10 Lateral abdominal spines of stage 4
- 11 Dorsal spines of stage 4: *a*, arising from cone-shaped base, *b*, directly from the body
- 12 Lateral abdominal spines of stage 5
- 13 Antennae in stage 5

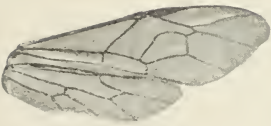
Plate 1



Eniscopilus arcuatus



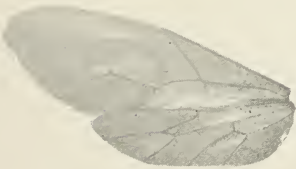
1



2



4



3



5

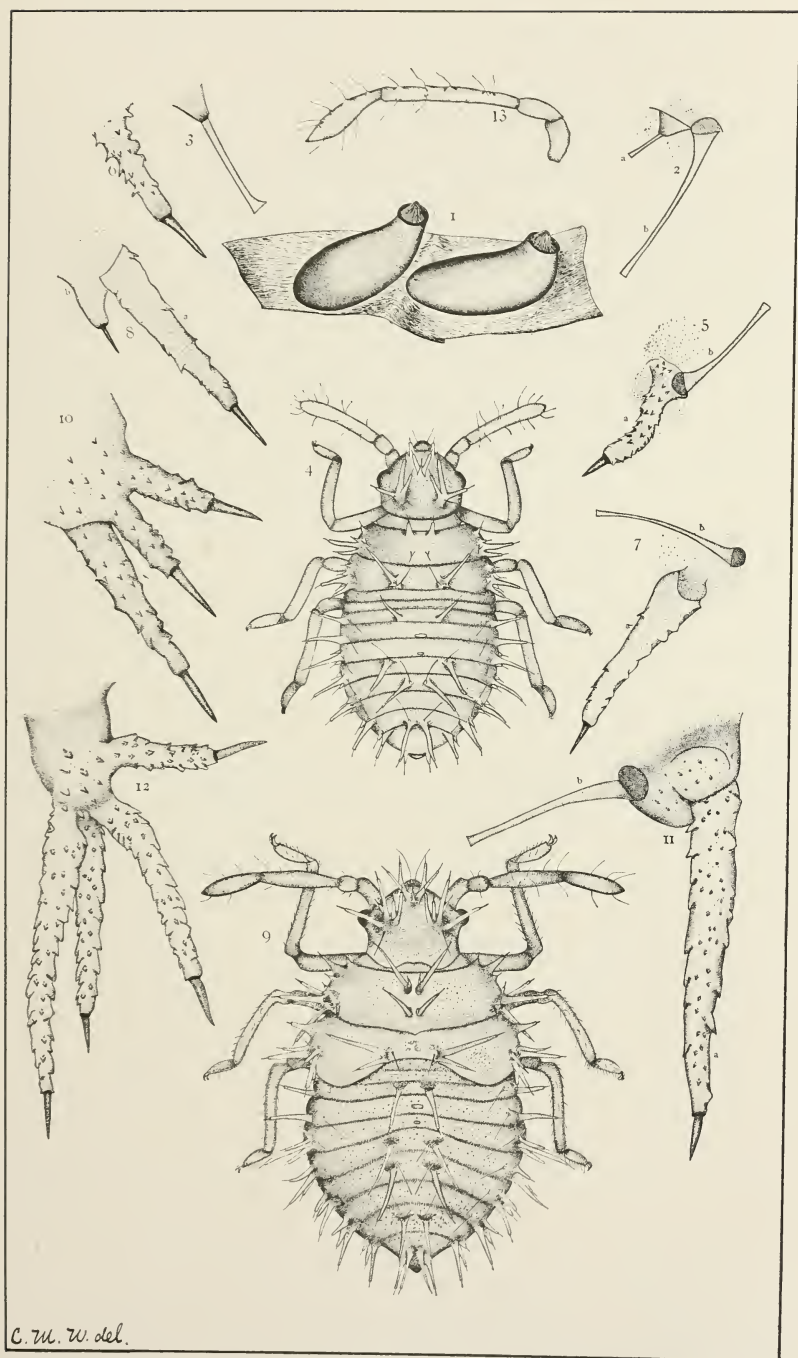


6

Plate 3



Work of chrysanthemum lace bug



Chrysanthemum lace bug

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New York State Museum

Bulletin 77

GEOLOGY 6

GEOLOGY OF THE VICINITY OF LITTLE FALLS, HERKIMER COUNTY

BY H. P. CUSHING

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Bulletin 77

GEOLOGY 6

GEOLOGY OF THE VICINITY OF LITTLE FALLS, HERKIMER COUNTY

AREA COMPRISED IN THE LITTLE FALLS QUADRANGLE

PREFACE

The study of the crystalline rocks of the Adirondack area by modern petrographic methods was begun in 1892 by Prof. J. F. Kemp under the direction of the writer in connection with the iron ore deposits in the vicinity of Port Henry and some results were published in Museum bulletin 14, *Geology of Moriah and Westport Townships, Essex County, N. Y., with notes on the iron mines*. Subsequently this work was continued and extended under the direction of Prof. James Hall, and Professors C. H. Smyth jr and H. P. Cushing were invited to participate in the study of this great crystalline area. The work of the three investigators in their separate fields has been published in the reports of the state geologist for 1893 and subsequent years, and has resulted in a wholly new light being thrown on the structure and geologic history of the district. Professor Cushing's special field has been the Northeastern Adirondacks and having successfully covered the part allotted to him so far as the existing maps of that region would permit, it seemed that it would be of much interest to make a detailed comparison of the northern pre-Cambrian geology with that of an area bordering on the Mohawk valley. The Little Falls quadrangle having been completed, this suggested itself as a convenient and interesting field for work. Professor Cushing accordingly, as a result of a careful study of this area, communicates the following report.

FREDERICK J. H. MERRILL

State Geologist

GEOGRAPHIC POSITION

The area comprised in the Little Falls atlas sheet lies mostly north of the Mohawk river between East Canada and West Canada creeks. The Mohawk runs across the sheet near its southern edge. The Canada creeks diverge and run out of the sheet limits, East Canada to the east, and West Canada to the west, about midway between the Mohawk and the north border of the sheet. The map extends over 15' of latitude, 43° to $43^{\circ} 15'$ n., and 15' of longitude, $74^{\circ} 45'$ to 75° w., comprising about 218 square miles.

Its geographic association is with the Adirondack highland region and the Mohawk valley lowland. South of the Mohawk the altitude rises quickly to that of the dissected plateau region of southern New York, this being wholly without the map limits. The lowland is worn down on a belt of rocks which are weak as compared with those to the north and the south. It is much narrower here than farther west, for the reason that rocks which here are resistant and hence belong to the plateau district, become both weaker and thicker as they are followed to the west, so that the belt which they underlie becomes merged with that of the lowland.

The lowland belt is an agricultural one and has been cleared and farmed this many a year. The district occupying the north-east portion of the map belongs however with the Adirondack highland belt and is still forest covered. But lumbering has been carried on for many years around the edge of the woods, so that within the limits of the map the timber has been mainly cut and the woods are therefore very thin. Fires have however not been as frequent as in many parts of the Adirondacks, and very little of the territory has been burned over. Sporadic cutting of timber is going on even yet, mainly hardwood, with here and there a spruce, the logs being hauled out singly throughout the year. The supply is sufficient to keep several small sawmills running.

GENERAL GEOLOGY

The detailed topography of the district can not be made intelligible without a knowledge of the rock structure and the geologic history of the region, since it depends on both. The study of the

rocks has brought out the facts here given and the detailed evidence will be presented later.

Sketch of physical changes. The rocks of the Adirondack region are among the oldest of which we have knowledge anywhere on the earth's surface. The history which they disclose is an exceedingly difficult one to decipher and has been only imperfectly made out as yet. It is however clear that it involves the passage of a prodigious lapse of time.

The oldest known rocks of the Adirondack region are of the sort deposited from water, and indicate that the region, probably in its entirety, was below sea level and receiving deposit on its surface. These deposits would seem to have been of the same, or very similar, sort as those now being deposited on shallow sea floors: sands, muds, calcareous muds and their intermediate gradations. These rocks were apparently deposited in great thickness, though we have no means at present of ascertaining what that thickness was. They must have accumulated on a floor of older rocks, but this older floor has not yet been certainly made out in the Adirondack region. It may or may not be present. Volcanic action seems to have been going on while these deposits were forming, or else occurred not long afterward.

After these conditions had persisted for a long time, the district was raised up out of the water, probably to considerable height, accompanied by a certain amount of folding, fracturing and tilting of the rocks. The surface ceased to receive deposit, and instead was attacked by the weather, the surface deposits were disintegrated and decayed, this loosened material commenced to move down hill toward the sea, and the surface was thus pared away bit by bit and lowered. This action continued through long ages till many hundred, likely a few thousand, feet of rock had been thus patiently removed.

The region also was early the scene of vigorous igneous action. Whether this preceded, accompanied and perhaps caused, or followed its uplifting above sea level is not known; but enormous masses of molten rock invaded the region from beneath in a great series of intrusions. Whether any of this material ever reached

the then existing surface, with manifestations of surface volcanic action, we do not know, likely never can know. But not improbably these masses may represent old reservoirs whence volcanic material ascended to the surface.

The old floor, on which the previous deposits had been laid down, was largely or wholly engulfed in the molten flood, as were the old deposits themselves to a large extent. These were invaded, broken up, and separated into disconnected patches by the eruptive rock, which then cooled and solidified far underground. There is a series of these igneous intrusions with varying composition. The heart of the Adirondacks felt the full force of this action. The present borders were more remote from it, the igneous rocks are less conspicuous there, and the old sediments occur in greater mass.

At some date after the igneous action had ceased, though probably commencing while it was still in progress, the rocks were subjected to strong compression, acting mainly from one side. The rocks were compressed, intricately folded, the sediments were made thoroughly crystalline, all traces of their original structures were obliterated, and a foliated structure was produced in them and in the igneous rocks as well.¹ The general process is known as metamorphism. Side pressures can not produce effects such as these in rocks near the surface, but only at considerable depth; and, since these rocks are now at the surface, it is argued that the rock covering under which they were buried at this early time has been slowly and laboriously removed by erosive processes during the long ages that have since elapsed. They were likely at a depth of at least from 3 to 5 miles below the surface at this time.

The region persisted above sea level for a long time, during which likely occasional movements of further uplift were in prog-

¹Under the temperature conditions which prevail at considerable depth and specially if moisture is present, high pressure produces rearrangement of the rock particles, mainly through recrystallization. The minerals form newly, mainly along certain dominant planes, and thus give the rock a layered arrangement. In sedimentary rocks this may or may not correspond with the old bedding planes. This layered arrangement of the constituent minerals constitutes foliation. Often ready splitting may be produced along these planes because of the concentration of a mineral with good cleavage there.

ress. As the surface was worn away, the present surface rocks were brought that amount nearer to the surface and were under the load of a constantly diminishing amount of overlying rock. From time to time renewed side pressures were brought to bear, these likely coinciding with times of renewed uplift and disturbance. But, as the rocks approached the surface in this slow fashion, the effects produced on them by the pressure would change in character. The pressure seems also to have been less pronounced than in the former stage and to have been mainly effective in producing joints.¹ Likely slipping and faulting also took place, but if so the faults have not yet been differentiated from those of a much later period.

Toward the close of this long erosion period, after much the larger part of the overlying rocks had been worn away, volcanic activity was renewed in the Adirondack region. The main center of the activity of this period was in the northeastern Adirondacks, and igneous rocks of this period make but little show in the south. They used mainly an eastwest set of joint planes for their ascent. We do not know whether any of this material reached the surface or not. If so, all traces of the surface materials have been since worn away. Nor has erosion anywhere cut deeply enough to disclose the old reservoirs whence these lavas arose, though they were the same in all probability as those whence came the material for the earlier great intrusions. We find exposed at the surface of today merely the old, lava-filled fissures which served as the channels of ascent for the molten rock. The surface outflows have disappeared through erosion and the original reservoirs are still buried in depth.

These rocks are known to be distinctly later than the other igneous rocks by various sorts of evidence. The dikes (the filled fissures) of the later rocks cut through the earlier. The later rocks are not metamorphosed as are the earlier. They have suf-

¹Joints are divisional planes, usually vertical or highly inclined, found in most rocks. There are in general at least two sets of planes nearly at right angles. There may be several sets. They result from both tension and from compression, and are only formed comparatively near the surface.

ferred deformation only to the extent of being jointed and faulted. Except for recent mere surface decay they are practically as when they cooled and solidified. They have therefore never been deeply buried, as have the rocks which they cut, but, on the contrary, seem to have formed not far from the surface, since some of them contain numerous gas cavities. Hence the larger part of the early erosion of the region must have been effected before their appearance and yet after the intrusion of the earlier eruptives.

The region was yet a land area at the time and so continued for a space. The result of the long protracted erosion of the surface was to wear down the old mountains to mere stumps, producing a region of comparatively low altitude and quite insignificant relief. There were stream valleys with low divides between and numerous low, rounded hills, whose tops were apparently no more than a few hundred feet above the valley bottoms as a maximum.

This old land area was of much greater extent than the present Adirondack region, though that was apparently a more elevated part of the surface then, as now, of less relief however and lower altitude. While the last, finishing erosion touches were being given to the present Adirondack region, the sea had already begun to encroach on its borders, either because of a sinking of the land area or a rising of the sea level. This movement persisted also for a long time, and the region seems to have become an island in the midst of the sea, of constantly shrinking area as the waters rose around it, till finally they seem to have overtopped it, completely submerging the whole. It is possible that a small area may have persisted above sea level throughout, though, it is not likely, and in any case it was very small.

As each successive zone of the district passed beneath the sea, it ceased to suffer wear on its surface and began to receive deposit instead. The last portion of the present Adirondack region to pass beneath the sea would seem to have been the southern part. Since subsidence and deposition were proceeding at the same time, each new layer of deposit would encroach a little farther on the old land surface than the preceding one. In other words, they overlapped on its slopes. The subsidence of this old land area

seems to have been unequal on different sides, and also to have varied locally from place to place. Around most of the Adirondack region the first deposit laid down on the subsiding floor was one of coarse sand, often becoming a coarse gravel and with much feldspar sand at the base. It was deposited in shallow water in which was sufficiently strong current action to remove all fine mud. This formation is thickest on the northeast border of the

IDEAL SECTIONS ILLUSTRATING OVERLAP ON A SINKING LAND SURFACE,
WITH MUCH EXAGGERATED VERTICAL SCALE



Fig. 1 Partial submergence; sand being deposited

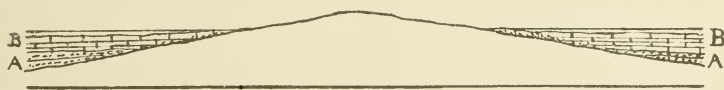


Fig. 2 More complete submergence; limestone being deposited above the sand and also on the newly sunken land surface



Fig. 3 Almost complete submergence; shale depositing on the limestone and overlapping on the old land surface; the material being derived from some adjoining land area and brought in by currents.

Adirondacks, thinning thence both westward and to the south, and on the present southwest border was not deposited at all, and is not found within the map limits. The formation which succeeds it elsewhere is here found resting on the old land surface. A more detailed discussion of the reason for its absence here will appear on a later page. This formation is known as the Potsdam sandstone.

Subsidence continuing, the character of the deposit changed and the Potsdam is overlain by a variable thickness of dolomite and limestone beds, the former much predominating and nearly always containing some coarse sand which becomes very prominent in some layers. These rocks are peculiar, are not like ordinary open sea deposits, and the exact conditions under which

they accumulated are not thoroughly understood. The formation is called the Beekmantown limestone, but was known as the Calciferos formation till recently. It is also thickest in the northeastern Adirondacks and diminishes in thickness to the south and west, so that near the region under immediate consideration it also disappears and the next succeeding formation is found resting on the old land surface. Within the limits of the map the different layers of the Beekmantown formation successively overlap on the old surface, so that a thickness of over 400 feet at Little Falls has diminished to nearly or quite zero at the northern limit of the sheet. The overlap is beautifully shown around Diamond hill, a low mound of the old land surface, and will be later described in detail.

Following the Beekmantown, a marine, fossiliferous limestone, the Trenton formation, was deposited, with two thin lower members, the Lowville (Birdseye) and Black River limestones. This formation was very unequally deposited and shows a very rapid diminution in thickness toward the east in the restricted district under consideration. The Lowville is a pure, drab, thick bedded limestone in which calcite-filled tubes abound, and is the main quarry rock of the district. The Black River is a massive, black, brittle limestone usually, and is only here and there present in the district, the Trenton usually following the Lowville directly. The Trenton is thin bedded and usually gray, though with some black layers, and many of the beds are a mass of fossil shells.

Toward the close of the Trenton, fine muds began to be washed into the previously clear sea, at first intermittently, producing a series of alternating limestone and shale bands, later more continuously, giving rise to the fine muds of the Utica formation. The abundant clear water life departed and was replaced by a different and much sparser assemblage of forms. During the deposition of this formation it seems probable, from several lines of evidence, that the present Adirondack region was either wholly submerged or else so nearly so that only a few small islands were left protruding above the water. Here again the deposit

seems to have been thickest on the northeast, though the discrepancy is not so marked as in the case of the Potsdam and Beekmantown formations.

Following the deposition of the Utica formation, came a movement of disturbance and uplift of the region on the northeast and east. This apparently raised the present Champlain valley and northern Adirondack region above sea level, while the southern portion was not affected and remained submerged, so that the deposit of sediment continued on the south, though interrupted on the north. The successive Upper Silurian and Devonian rocks are now found outcropping in regular order as one goes south from the map limits, presenting their beveled edges to daylight. They all extended farther north originally. It would seem very probable, nay almost certain, that the higher Silurian rocks were deposited over the map limits and have since been removed by erosion. Quite possibly the Devonian also, in whole or in part, was so deposited.

There is a certain amount of evidence going to indicate that, during the late Silurian and early Devonian, the northern region became depressed again for a time and received deposit on its somewhat worn surface. But such deposit has been since wholly removed by erosion so far as northern New York is concerned, leaving us in entire ignorance as to its thickness, character and extent. Had these deposits been thick and of wide extent, however, we might reasonably hope to find remnants of them today, here and there. There is no evidence whatever that any rocks of later age than the Devonian have ever been deposited in, or about the Adirondack region, the recent Champlain clays and sands being of course excepted, and the evidence for the deposit of any of the Devonian is of the scantiest sort.

Probably coincident with the Taconic disturbance at the close of the Lower Silurian, occurred the last manifestation of igneous activity in the Adirondack region. This was mainly confined to the near vicinity of Lake Champlain, at least so far as the New York side is concerned. The igneous rocks of this date are now found in dikes, and occasional somewhat larger intrusive masses,

which cut and are therefore younger than all the rocks of the region, up to and including the Utica formation. Their date can not be fixed more definitely than this.

On the south also there is evidence of igneous action of later date than the deposition of the Utica formation. A few dikes are found cutting this and the older rocks as well, which may or may not be of the same age as those of the Champlain valley. They are of a somewhat different sort of rock from any found there, and this may possibly argue for a difference in age. None of these dikes have been noted within the map limits, but three outcrop along East Canada creek just east of those limits. In character they show a closer relationship with some igneous rocks

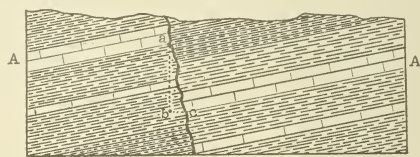


Figure 4

of apparent post-Devonian age which occur sparsely in central New York and they are probably related to them, rather than to the Champlain dikes.

Since the deposition of the Potsdam, Beekmantown, Trenton and Utica formations, the region has also suffered deformation, which has affected them as well as the older rocks. This later deformation has not been severe however. The rocks are but slightly folded, but are, on the other hand, considerably faulted and jointed.¹ This deformation period is of uncertain date except that it is later than the deposition of the rocks. Quite possibly

¹A fault is produced by a sliding movement of the rocks on opposite sides of a fissure, with the result that the same rock stratum is higher on one side than on the other, as illustrated in the accompanying diagram [fig. 4]. The stratum AA has been dropped on the right side of the fault relative to its position on the left side. The distance *ac*, measured along the fault plane, is called its *displacement*, the vertical distance *ab*, that separates the two ends of the stratum, is called the *throw*, and the horizontal distance *bc* is the *heave* of the fault.

the first faulting of the region took place at the close of the Lower Silurian coincidently with the Taconic disturbance. But, even so, a fault once formed constitutes a line of weakness, along which further faulting is likely to occur whenever the region experiences further disturbance. It is by no means unlikely that repeated slips have taken place along the fault planes since they were first formed.

Two such faults, the Little Falls and the Dolgeville faults, are found within the limits of the map, and thence eastwardly faults cross the Mohawk valley repeatedly. The Little Falls break is the most westerly one which has been detected in the State so far as the writer is aware, though it is not at all unlikely that small ones, at least, will be brought to light farther west. The Little Falls fault has a throw of nearly or quite 800 feet at Little Falls, and is hence of very respectable magnitude. There is another fault on lower East Canada creek, just beyond the map limits to the east.

The Little Falls district has been nearly or quite continuously above sea level for a long time; since Devonian time in all probability and likely during a part of the Devonian also. The length of this period of time in years can be measured by no one with any degree of exactness, but a few million years are involved beyond any question, and quite likely a good many million. During this time its surface has been undergoing wear instead of receiving deposit. A considerable thickness of the rocks which mantled the surface as it rose above the sea has since disappeared, and the present surface rocks are such because of the removal of what originally lay above. Undoubtedly the shales of the Utica formation once covered the entire area. They have now disappeared from more than half of it. The Trenton has also been worn away from much of the surface, so has the Beekmantown, and the old floor of all these rocks has been eaten away somewhat in the localities where it is now exposed at the surface. Such later formations as may have been deposited have been wholly removed. We can imagine them as replaced in their old position, since we know their order and thickness from their outcrops to the south, but

we do not know at just what point to put the curb on our imagination.

The manner of progress of the wear on this land surface has depended on the rock characters and structures and must be left for later consideration. During this long time interval, the region has experienced changes of altitude, in part because of wear, in part because of up or down movements of the earth's crust. We are as yet far from being able to trace out these movements.

In times very recent comparatively, namely only some thousands of years ago, the district was covered by the ice sheet of the Glacial period. How long this condition persisted, how many times the ice came and went over the immediate region, we do not know. The advancing ice sheet removed the soil and loose rock from the surface and scoured away at the rock ledges beneath. The retreating ice sheet spread a heavy mantle of deposit over the surface. The melting ice gave rise to streams and lakes which rehandled some of the glacially deposited material. The larger preglacial topographic features were little changed and remain today substantially as they were before the onset of the ice. The minor irregularities of the surface were largely obliterated however, mainly by the deposits laid down during retreat. The stream valleys were filled nearly or quite to the brim, and the modern streams are largely in new courses therefore, specially the smaller ones. Unequal valley filling, and unequal deposit elsewhere left hollows in the surface in which lakes now nestle, lakes which had no existence before the advent of the ice. The Mohawk valley lowland is a preglacial feature, but the preglacial divide between the east and west flowing streams in this lowland seems to have been at Little Falls, and was certainly not at Rome, its present position. After the ice, on its last northerly retreat, had uncovered the Mohawk valley but still lay across that of the St Lawrence, the drainage of the Great lakes passed to the sea by way of the Mohawk, the eastern end of the lake in the Ontario basin being at Rome. The present Mohawk is an insignificant stream as compared with its great predecessor, which has of course left its mark on the valley.

The time since the departure of the ice has been so comparatively short, that the surface is substantially as the retreating glacier left it. During the retreat of the ice a slow movement of uplift was in progress in the region, and continued thereafter; in fact there are strong reasons for the belief that it even yet continues. Because of this change the Little Falls region stands today at an elevation exceeding by from 250 to 300 feet what it had when the last ice lay on it.

The streams of the region have either reexcavated their old valleys or are engaged in cutting new ones, but the time is not sufficiently long to have enabled them to make great progress in the latter task. Besides, the recent rising movement of the region has constantly lowered the level to which the streams can cut. Even the Mohawk is not down to base level at Little Falls and elsewhere. Away from the streams the glacial topography has been but little changed.

THE ROCKS

Pre-Cambrian rocks¹

These ancient rocks are found at the surface over a large area occupying the northeast portion of the map, extending thence northward without a break through the entire Adirondack region. In addition, they appear at three disconnected localities, at Little Falls, Middleville, and at a spot locally known as the "Gulf," $2\frac{1}{2}$ miles northeast of Little Falls.

The Little Falls and Middleville outliers. The pre-Cambrian rocks exposed at these two localities are identical, are quite homogeneous throughout, and are somewhat different in character from those exposed elsewhere. They are quite certainly old igneous rocks and belong to the syenite family of these rocks. They consist mainly of feldspar, always show some quartz, usually from 5% to 15% of the rock in quantity, and usually have only a small content of dark colored minerals, magnetite, hornblende, pyroxene and black mica. These minerals form a granu-

¹A more detailed and technical description of these rocks will be given in the closing pages of this report.

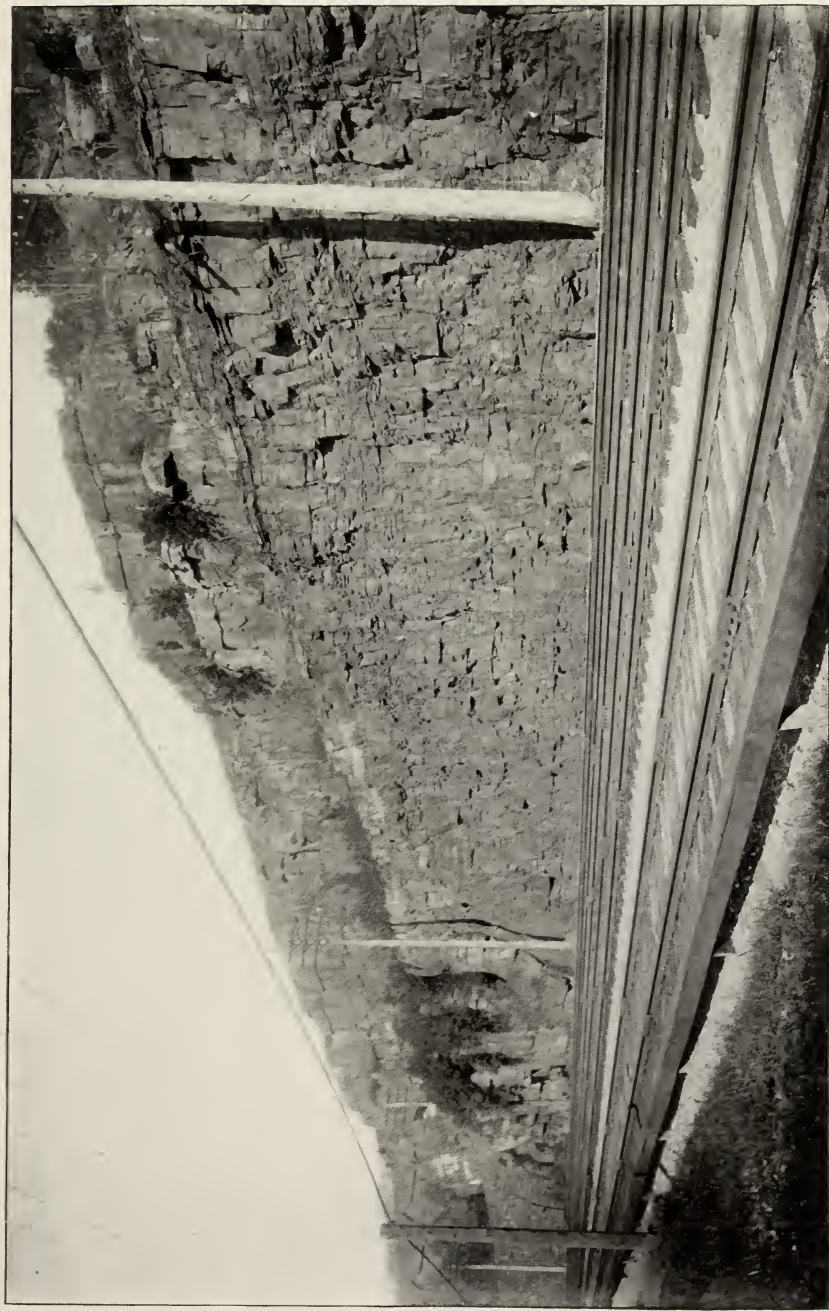
lar mosaic in which are set feldspar crystals of varying size, whose glittering cleavage faces, on freshly broken surfaces, form the most noticeable characteristic of the rock. At Middleville these are very abundant and large, often reaching an inch and more in length, and the rock is much the coarsest syenite that has been found anywhere in the Adirondack region. In fact, it very strongly resembles in appearance much of the igneous rock called anorthosite, which has wide extent in the eastern Adirondacks. Both are composed mainly of feldspar, but the feldspar is of widely different character in the two. That of the anorthosite is apt to show striations, looking like fine ruled, parallel scratches, on the bright cleavage faces, but such striations do not appear on the syenite feldspar. The two differ much in chemical composition also.

The syenite at Little Falls is more widely and much better exposed than at Middleville, is by no means so coarse, varies more in character from place to place, and in part shows no large feldspars whatever. As shown along the Little Falls and Dolgeville Railroad, it was described in a previous report to the state geologist.¹ South of the Mohawk it is more homogeneous and more usually porphyritic than on the north side.² The westerly exposures, in and about the city, show considerable red, fine grained, granitic rock cutting the syenite.

This syenite has undergone extensive metamorphism, so that it has been rendered thoroughly gneissoid, and the finer grained portion of the original rock has been mostly, or wholly, recrystallized. The large feldspars also have been diminished in size by the breaking away of fragments from their exteriors. In general the Little Falls rock is much finer grained and vastly more gneissoid than that at Middleville. In places at Little Falls the large feldspars themselves have been completely crushed to a mass of fragments, and drawn out into lens-shaped patches, around which the foliation curves, as it does also around the uncrushed, large feldspars.

¹N. Y. State Mus. 20th An. Rep't. p.183.

²A porphyritic igneous rock is one which shows more or less numerous crystals, surrounded by more finely crystalline, or even stony or glassy rock material.



C. S. Prosser, photo.

View of the cliff of pre-Cambrian syenite at Little Falls, looking west

Since these are small outliers and consist practically wholly of syenite, they can furnish no decisive evidence of the age of the syenite as compared with that of the other pre-Cambrian rocks. It has been stated that the Grenville rocks are closely involved with apparent igneous rocks which seem to have been either contemporaneous with them or to have been intruded into them not long after their deposition. Also that at a later date there was a time of great igneous activity in the region, when huge masses of molten rock were intruded into the Grenville rocks; and that at a third and much later time there was a further renewal of igneous activity, though in a minor degree. The writer's disposition is to regard the syenite under discussion as dating from the second of these periods, and as of much the same age as the the great syenite, anorthosite and gabbro masses of the central and eastern Adirondack region, but it should be emphasized that there is no decisive evidence in proof of this view. These two small areas are likely connected underneath and represent portions of the surface of the same mass, and it certainly represents a different intrusion from those in the heart of the woods, though regarded as belonging to the same group of intrusions.

Diabase dike. The only representative of the third igneous period which has been discovered within the map limits, is a huge dike of the rock known as diabase, which is exposed about a half mile east of the Little Falls depot along the Dolgeville Railroad. The rock is black and fine grained, with many half inch, porphyritic feldspars, of a general greenish gray, dull appearance because of alteration. Near the edges of the dike the rock becomes very black and dense and of stony texture, because of more rapid cooling and solidification there, due to the chilling effect of the walls. The dike is at least 120 feet in width, an unusually large size for these Adirondack dikes.

Grenville rocks. In the main pre-Cambrian exposures within the map limits, rocks which are of apparent sedimentary origin, and hence classed as of Grenville age, play an important part. The extreme metamorphism which they have suffered has produced complete recrystallization, with consequent disappearance

of all traces of the original structures which characterize the sedimentary rocks. The argument for their sedimentary origin rests on their composition, mineralogic and chemical, and on their frequent variations in composition, beds of different original character having produced differing metamorphic rocks, whose comparatively sharp junctions look like old bedding planes.

The most characteristic rocks of the Grenville series are the crystalline limestones, but these have not been found within the map limits. A single large boulder of impure crystalline limestone was noted on the surface of the heavy moraine which covers the district occupying the extreme north-central part of the map. As it is a soft and quite easily destroyed rock, these limestone boulders commonly indicate a parent ledge near at hand, here probably to the north, not far beyond the map limits.

In the absence of limestone, the rocks regarded as characteristically Grenville comprise a series of light colored, often white gneisses, very rich in quartz, interbanded with less quartzose rocks of darker color, and often with a very respectable percentage of black minerals, hornblende, black mica and magnetite. Both rocks contain, often in abundance, garnets of somewhat unusual color, a much lighter red than ordinary and with a rather pink tinge. These are more conspicuous in the dark rocks in general, but the light colored ones are seldom without them. They are commonly of about pinhead size but often run larger, specially in the darker rocks, those with diameters of from $\frac{1}{8}$ to $\frac{1}{4}$ inch being often quite numerous, and even larger ones are to be found.

Another mineral which is very characteristic of these rocks and strongly indicative of their sedimentary origin, is graphite (black lead). Shining, metallic looking scales of this mineral occur frequently in the darker rocks, usually of sufficient size to be made out by the unaided eye.

Another characteristic mineral, this time confined mainly to the light colored rocks and only visible under the microscope, is sillimanite.

As has been said, the light colored rocks consist almost wholly of quartz and feldspar and are rich in quartz. Their composition

would indicate that originally they were sandstones, generally more or less shaly. In many of them the quartz is now found in thin, regular leaves separated by very finely granular feldspar, and such "leaf gneisses," as Dr F. D. Adams of the Canadian Survey has happily styled them, are a very conspicuous feature of the Grenville rocks. However, the severe metamorphism to which most of the pre-Cambrian rocks have been subjected has recrystallized much of their quartz in the leaf form, both in those of igneous as well as in those of sedimentary origin, so that this character can not be regarded as in any sense indicative of origin. It is naturally best exhibited by rocks rich in quartz, and some rocks which were likely granites originally show it in great perfection.

The darker colored rocks would seem to have been shales and calcareous shales originally. They must have contained a small amount of carbonaceous matter, very possibly of organic origin, now metamorphosed to graphite. Many ordinary shales and limestones contain carbonaceous matter, so that the supposition is a very natural one.

These Grenville rocks are very like rocks which Kemp has recently described from Warren and Washington counties, to the eastward, where they also occur in abundance, and where limestone is relatively scarce. From the standpoint of one who is familiar with but one of the two districts and necessarily depending on descriptions for a knowledge of the other, the rocks would seem identical in the two areas, and not unlikely the whole pre-Cambrian fringe on the south side of the Adirondacks will be found to be characterized by abundant Grenville rocks with a scarcity of limestone.

Probable igneous rocks associated with the Grenville. At most of the Grenville exposures of any extent, rocks which are regarded as igneous are found mingled with them. They are always thoroughly gneissoid and are interbanded with the old sediments. They are thought to represent old dikes and sheets of igneous rock, possibly surface flows also, which were formed during, or not long after the deposition of the sediments, and

which have been recrystallized and stretched out into rude parallelism with the sedimentary beds as a result of severe metamorphism.

Though of somewhat variable nature, they present three main types:

1 Red gneisses which have the mineralogy of granites, and are thought to have corresponding chemical composition also, though they have not been analyzed. They are usually fine grained and with quartz of a pronounced leaf type.

2 Black, hornblende gneisses, sometimes with pyroxene also and usually with black mica (biotite), which have the composition of gabbros or diabases.

3 Greenish gray gneisses, which have somewhat the color and appearance of very gneissoid varieties of the syenite previously described, and are very difficult to distinguish from them when occurring alone. They are commonly very quartzose, more so than the usual syenite, and very distinctly of the "leaf gneiss" type. They are very like the red gneisses of the first type under the microscope, have the mineralogy of granites, or of quartz syenites, and are regarded as igneous rocks. Their possible relationship with the Little Falls syenite is an exceedingly difficult problem, not as yet satisfactorily solved, though they are hesitatingly regarded as distinct and as older.

Though all these rocks are usually found interbanded with the Grenville sediments, so that there can be little doubt as to their close association, they may occur elsewhere unaccompanied by the sedimentaries, or with these in very minor quantity, and such areas have been given a separate coloration on the map, though the distinction is not a sharp one, and there is some question as to its wisdom.

Syenite gneiss. There is a considerable area shown in the north-eastern part of the map where the rock is of the same sort throughout. The exposures are all in the woods and of the unsatisfactory sort that obtain there. The rock is thoroughly gneissoid, of a greenish color and weathers rapidly to a dingy brown. Most of the exposures show nothing but the brown rock, though usually

freshly broken surfaces will show at least patches of the green. The grain is usually quite fine, but the quartz is coarser than the other constituents and tends often to the "leaf" type, though but rudely so. In places a few larger feldspars show also and appear like small examples of porphyritic feldspars. The rock is prevailingly of feldspar, and feldspar of an acid type. It is quite quartzose, that mineral making from 15% to 20% of the rock on the average with a usual range of from 10% to 30%. Pyroxenes are the usual dark colored constituents, though both hornblende and biotite mica also occur. Without going into detail at this point suffice it to say that the rock has the precise mineralogy of an augite syenite, the same mineralogy as the rock at Little Falls and Middleville, and the same as the great mid-Adirondack syenite masses. It differs from them in being in general somewhat more quartzose, in being everywhere thoroughly gneissoid, and in the lack of porphyritic feldspars. It is however not to be in any way distinguished from some varieties of the rock in the other exposures. On the other hand, it has nearly, if not quite, as strong a resemblance to the greenish gneisses (3) just previously described.

Mixed rocks about the syenite. A large part of the pre-Cambrian area of the sheet shows rocks which are very like the syenite rocks and are thought to represent phases of them, but which are inextricably intermingled with smaller masses of undoubted Grenville rocks. The syenitic rocks predominate, though they are not of the normal type, but the Grenville rocks are in considerable force, and the relations between the two are wholly obscure. It was found impossible to separate the two in mapping on this scale, and therefore the complex as a whole is given a separate coloration on the map. Since the rocks seem to pass into the syenites on the one hand, and into belts in which the Grenville sediments preponderate on the other, the mapping of boundaries must, however, be a wholly arbitrary matter.

A very mixed lot of rocks is found in this belt as mapped, and with frequent changes from one sort to another. The most abundant type of all is a greenish gneiss, weathering brown.

which is richer in biotite, hornblende and pyroxene than the usual syenite. Metamorphism has concentrated these minerals along certain planes, producing a marked gneissoid structure, and a rock varying from green to black in general color. Where thus enriched by these minerals the rock approaches more nearly to a gabbro in composition, otherwise it is a syenite, though often very quartzose. With the increase in the quartz percentage the color often changes with facility from green to red and back again, just such a color change as is often seen in the great Adirondack masses of syenite. Bands of very basic feldspar, hornblende, biotite gneisses occur frequently with the others, and the whole series is cut by a multitude of small veins of quartz and pegmatite. Rocks like these appear in a multitude of exposures. All have the mineralogy of igneous rocks and are believed to be such.

Along with these a rock repeatedly occurs which resembles somewhat the green and black gneiss of the above, but contains garnets numerously also. It has the mineralogy of a rather basic igneous rock, neither a gabbro nor a syenite however, but of a rock intermediate between them and known as monzonite. It passes on the one hand into the syenite gneisses and on the other into the darker colored gneisses, often with graphite, of the Grenville series, the lighter colored gneisses appearing with these at times also. The whole series is perplexing and uncertain. The rocks differ considerably from the red, black and green gneisses previously described and regarded as igneous rocks of Grenville age. A possible, and perhaps the simplest explanation of the whole is that it is a sort of border belt between the syenite and the Grenville rocks, in which these last were all cut up by the syenite intrusion and in which they now occur as patches. Many contact rocks were formed and the whole subsequently was severely metamorphosed.

There still remains the question of the relationship of this syenite to that at Little Falls and Middleville, and to it the writer is unable to give any definite answer. If they are equivalent, it is strange that the pronounced porphyritic character of the rock of the two outliers should have so utterly disappeared in the main mass. Yet it may be legitimately argued that the porphyritic

texture is usually of local development in deep seated igneous rocks, that much of the rock at Little Falls lacks it and is thoroughly gneissoid, hence presenting an intermediate stage between the rock at Middleville and that of the main mass, and that in the great syenite masses of the central Adirondacks the bulk of the rock is not porphyritic, and the porphyritic development is local; also these are, at least in part, demonstrably of considerably younger age than the Grenville rocks.

Moreover, as has been stated, this syenite is almost equally hard to distinguish from the greenish gneiss of syenitic composition found so closely associated with the Grenville sedimentaries, and the granitic and gabbroic gneisses that accompany them. While this greenish gneiss is regarded as an igneous rock, it seems quite certain that its age association with the sedimentaries is close, as is also that of the accompanying granitic and gabbroic gneiss. It is also true of these latter that they are certainly much older than the gabbros and some granites which occur in the mid-Adirondack region, and it would seem therefore that the same might well be true of the syenite also. The green gneiss is regarded as being of this earlier age, so that there seem to be syenite rocks of at least two different ages in the Adirondack pre-Cambrian. But the writer is in doubt with regard to the syenite mass of the northeast part of the map, though disposed to regard it provisionally as belonging to the earlier period and to correlate it with the green gneisses of the Grenville. In regard to the rock at Little Falls and Middleville, he is also in doubt, though here with a disposition to refer to the later period, and to correlate with the later syenite of the central Adirondack region. The whole matter is one of great difficulty, and no decisive evidence for either view has yet been forthcoming anywhere.

Pre-Cambrian outlier northeast of Little Falls. There is exposed here a gray gneiss with a slight greenish tinge. The exposure is very small and shows but the one sort of rock. It is in the main a quartz feldspar rock, not more than 5% of other minerals being present, mostly magnetite, biotite, and a decomposed mineral which was likely a pyroxene. Quartz makes some 20% of the rock.

From 20% to 25% of the feldspar is oligoclase and the remainder is anorthoclase. The composition is that of a rather acid quartz syenite, and the rock is provisionally classed with the green gneisses associated with the Grenville rocks.

Paleozoic rocks

Potsdam sandstone. Though it has been sometimes held that this formation is present in a small way in the district, the writer found nothing that would warrant its mapping as a lithologic formation distinct from the Beekmantown. At the base the Beekmantown is often more sandy than usual and even pebbly, sometimes a thin shale band creeps in as at Little Falls, and sometimes a thin, disintegration conglomerate or breccia band, composed mainly of fragments of the underlying rock, is locally found. But these phenomena are precisely what would be expected, as an old land surface sank beneath sea level and began to receive deposit. These lower layers vary greatly in character from place to place, always are somewhat calcareous and usually are prevailingly so, and seem to have nothing in common with the coarse, pure quartz sands of the Potsdam formation. Furthermore, beds of this character are not confined to the base of the formation but equally sandy, sometimes pebbly, beds are found here and there at various horizons. Moreover, since the Beekmantown formation overlaps on the pre-Cambrian, the formation thins going north from the Mohawk, and hence successively higher and higher beds become basal. The small area near Salisbury, which Darton has mapped as Potsdam is, though basal, at an horizon at least 200 feet above the bottom of the formation as shown at Little Falls. The same characters run through several layers in the distinct overlap of the formation at Diamond hill, the ordinary character being resumed at a little distance from the spot, and the rock is still somewhat calcareous and has not the lithologic character of the Potsdam.¹ Nor does the basal bed at Little Falls appear to represent the real base of the formation, deep well records to the west seeming to indicate an increased thickness in that direction, under

¹N. Y. State Geol. 14th An. Rep't 1894. Map at p.33.

cover of the younger rocks. These are at a greater distance from the pre-Cambrian outcrops than are the exposures at Little Falls, and this increased thickness is no doubt due to overlap, as is the diminished thickness in the other direction. It is therefore held that there is nothing which can be mapped as a formation, corresponding to the Potsdam, in this portion of the Mohawk valley, but that the Beekmantown rests everywhere on the pre-Cambrian, overlapping on its surface. It is by no means impossible that the Potsdam may come in below, farther away from the present pre-Cambrian edge of outcrop, but there is yet no decisive evidence that this is so.

It is also possible that the base of the Beekmantown, as exposed at Little Falls, may be of Cambrian age. This can only be determined by fossils, and as yet these have not been forthcoming in sufficient number and variety to settle the question.

Beekmantown formation.¹ The Beekmantown rocks are best exposed about Little Falls, Middleville and Diamond hill, though presenting numerous outcrops elsewhere. In the main, they consist of a gray, more or less sandy dolomite. Occasional layers are very sandy and sometimes even pebbly, and such layers are not confined to the base but may appear at any horizon. Some sandy layers show bright, glittering cleavage faces when broken. Such layers are found in the formation all about the Adirondack region,

¹The paleozoic rocks of the Mohawk valley have been much studied and described, and the writer's work has added little to our knowledge of them except for some structural details. The main purpose of the work was the study of the pre-Cambrian rocks; and, since the prosecution of this work required considerable traversing of the rest of the area, it seemed a pity not to grasp the opportunity to delimit all formation boundaries on the accurate base of the recently published new map. The more important papers touching on the stratigraphy of the immediate district are as follows:

Clarke, J. M. U. S. N. Y. Handbook 15. p.60-63

Darton, N. H. N. Y. State Geol. 13th An. Rep't. 1893. 1:409-29

——— N. Y. State Geol. 14th An. Rep't. 1894. p.33-53

Hall, James. N. Y. State Geol. 5th An. Rep't. 1885. p.8-10

Prosser, C. S. Am. Geol. 25:131-62

——— N. Y. State Mus. Bul. 34, p.469-70

Prosser & Cumings. N. Y. State Geol. 15th An. Rep't. 1895. p.632-37

Vanuxem, L. Geol. N. Y. 3d Dist. 1842.

and the writer has elsewhere shown that the appearance is due to a secondary calcite cement deposited between the sand grains, so that they become as it were incorporated in calcite crystals whose cleavage gives the characteristic appearance to the broken rocks.¹

Many of the beds of the formation, in the Little Falls district, are full of small, drusy cavities which are in general coated with minute dolomite crystals, sometimes with calcite as well. In these cavities are often one or more quartz crystals, generally small and water clear, though sometimes of quite large size, the latter usually full of inclusions. These crystals have long been known and have made the district a famous one to the mineralogist. They are locally known as diamonds and have given the name to Diamond hill, where they are very abundant, as they are also about Middleville. In addition, the cavities often contain much of a black, carbonaceous material, sometimes nearly filling the cavity, sometimes as films on which the dolomite crystals rest, sometimes running into cracks of the rock, and sometimes occurring as inclusions in the quartz crystals in a finely divided state. This material has heretofore been called anthracite, behaves precisely like that substance when heated and must have the same approximate chemical composition, though with somewhat different physical properties. From the standpoint of origin it would seem to be certainly an asphalt derivative. It was the first substance to form in the drusy cavities and was followed by the dolomite crystallization, though the two seem to have overlapped somewhat. Both the quartz and the calcite were formed after the dolomite. The writer observed no instance of a cavity in which quartz and calcite were both present; so that it can not be stated which of the two was formed first.

Near or at the summit of the Beekmantown formation, is a very cherty layer, becoming locally a pure mass of chert, which is sometimes red in color. This cherty layer often has a mineralized appearance, due to abundant, small, bluish green spots which have some resemblance to green copper carbonate (malachite).

¹N. Y. State Geol. 16th An. Rep't. 1896. p.19.



C. S. Prosser, photo.

The Beekmantown formation at Little Falls. Boyer quarry in sandy dolomite, forming the basal portion of the formation; a shale band shows at the base, and the pre-Cambrian lies just beneath.

There is however no copper at all in the rock and the green spots appear to be constituted of glauconite.¹

A certain amount of mineralization is sometimes to be noted in some of the layers of the formation, zinc blende (sphalerite), galena, pyrite and chalcopyrite all occurring, though always in small quantity.

The Beekmantown formation is overlain by a pure gray limestone known as the Lowville. The Chazy limestone lies at this horizon along Lake Champlain, but does not appear in the Mohawk valley. Its absence is due to a cessation of deposition in the Mohawk region and an uplift which probably raised the district slightly above sea level, sufficiently to stop deposition, but not sufficiently to permit of much wear. This uplift likely involved all of the State except the Champlain region, and persisted through the latter part of Beekmantown time and throughout the Chazy. Then subsidence was renewed, though but slowly at first.²

In the Little Falls district the upper boundary of the Beekmantown is not everywhere sharp, a grading into the Lowville through a series of passage beds of intermediate character being often seen, as was first noted by Prosser.³ These beds are of no great thickness, 8 feet being the maximum noted by the writer, along White creek nearly 3 miles north of Middleville. Prosser measured 11 feet at Newport on West Canada creek not far west of the map limits. These beds are of too slight thickness and too interrupted to map separately on a map of this scale, and have been therefore included with the Beekmantown, the base of the Lowville being made at the first pure limestone stratum.

¹Glauconite is a mineral of varying composition, but essentially a silicate of iron and potash. In sedimentary formations it has often a close association with the skeletons of minute organisms; and, since the chert is likely of organic origin, the association is a natural one. It is not at all indicative of any mineral content of value in the bed.

²The Chazy formation is over 800 feet thick toward the lower end of Lake Champlain, and diminishes rapidly in thickness to the south and west till it wholly pinches out. Moreover the entire Lower Paleozoic rock series is thickest on the northeast, diminishing thence west and south, so that more profound subsidence appears to have characterized the former region throughout.

³N. Y. State Geol. 15th An. Rept. 1895. p.627-31.

Just east of Middleville the upper layer of the Beekmantown is a coarse conglomerate, consisting of pebbles of quartz and chert in a matrix of quartz sand grains, cemented by calcite. This conglomerate was noted at but the one locality, but elsewhere a very sandy, sometimes slightly pebbly, layer, often full of pyrite (marcasite) is seen at this horizon, instead of the usual chert layer.

The best exposures of the Beekmantown are those at Little Falls, where, on the south side of the river, nearly every foot of the 450 feet thickness of the formation may be seen. The exposures about Middleville are also very good, though the thickness has dwindled to about 200 feet, and a section so nearly continuous can not be seen. The contact on the pre-Cambrian is shown in the West Shore railroad cut at Little Falls, and also in the banks of Spruce creek at Diamond hill [see pl.3]. It formerly showed, in the Boyer quarry at Little Falls, and even yet almost does so. All along the line of contact on both sides of the river at Little Falls the contact just escapes showing.

The Spruce creek locality has been noted by both Vanuxem and Darton.¹ The pre-Cambrian rocks there are garnetiferous Grenville gneisses with quartz veins, with some basic layers, and some rusty weathering beds full of pyrite. One of the latter is at the contact for the slight length of its exposure, and plate 3 illustrates its rapidity of weathering as compared with the overlying Beekmantown. The more resistant quartz veins project into the overlying Beekmantown layer, so that specimens of almost solid quartz can be broken out from it. Otherwise it, and the next two layers, have an arkose character, and the lower of the two is quite pebbly. They are also full of pyrite locally. While their materials are somewhat waterworn they consist merely of more or less weathered fragments of the underlying rocks, the resulting rock being mainly a product of weathering rather than of sedimentation. But these beds grade rapidly into the ordinary Beekmantown above, are themselves somewhat calcareous, and make a perfectly logical basal layer for the formation. In plate

¹Geol. N. Y. 3d Dist. p.255.

N. Y. State Geol. 13th An. Rep't 1893. p.417.



H. P. Cushing, photo.

Contact of Beekmantown on pre-Cambrian in Spruce creek at Diamond hill. The upper pre-Cambrian decays readily, and the actual contact is visible for only a few feet and can not be clearly brought out in a photograph. The pre-Cambrian shows best at the right.



N. H. Darton, photo.

Beekmantown-pre-Cambrian contact in West Shore Railroad cut at Little Falls. The plate shows the pebbly character of the lower Beekmantown layer, but this is a not infrequent character in the district. The pre-Cambrian is augite syenite.

4 the contact on the south side of the river at Little Falls is excellently shown. The lower layer is quite pebbly and extra sandy, as it is at Spruce creek, but the basal layer at Spruce creek, because of overlap, is from 150 to 200 feet above this pebbly layer at Little Falls. It is unlikely that this latter represents the actual base of the formation and a reference to the Potsdam because of lithologic character seems wholly uncalled for in view of the above facts.

The contact with the overlying Lowville limestone is shown at numerous localities within the map limits, and at many others shows within a few feet. A number of the tributary creeks into West Canada creek, both above and below Middleville, expose this contact. Some of the creeks into the Mohawk from the south also expose it, and it is well shown about Ingham Mills. A comparison of these different contacts brings out some interesting things in regard to the presence or absence of the passage beds, and variations in thickness of the Lowville down to complete absence, going to show great local variation in deposition conditions at this horizon, and indicating, when coupled with the occurrence of the local conglomerate at the summit of the Beekmantown, a probable slight unconformity.

Trenton formation. The Trenton formation as mapped is made to include the Lowville and Black river limestone stages as well as the Trenton limestone, since in the district these are mainly too thin and too variable to be mapped separately from the Trenton without exaggeration. They lie below the Trenton and can in general be assumed to represent the basal 5 to 15 feet of that formation as mapped.

Lowville limestone. The different beds of this formation are very similar, consisting of gray, brittle, pure limestone layers in which are more or less numerous long, tubular cavities filled with white, crystalline calcite, which are exceedingly characteristic of the formation. Other fossils are very rare, though *Leperditia*, a fossil crustacean shell looking like the half of a small bean, occurs occasionally. It is the purest limestone in the district, is fairly thick bedded, and has therefore been considerably quarried for building stone for local use.

About Middleville the formation ranges from 15 to 21 feet in thickness, the 6 to 8 feet of passage beds being excluded. To the westward it is still thicker, as shown by Prosser about Newport. South from Middleville it quickly dwindles to an average thickness of about 10 feet, and this it keeps all along the Mohawk to the east limits of the map, ranging from 8 to 12 feet thick. About Ingham Mills, Prosser has measured one thickness of a little more than, and another of a little less than, 10 feet.

The upper boundary of the formation is commonly sharply defined, the overlying Black river or Trenton being of quite different character and passage beds being lacking. Occasionally a layer with the lithologic character of the Lowville recurs a few feet above the summit of the main formation, as has been shown by Prosser at Ingham Mills, but this is exceptional.

About Diamond hill and thence northward, the Lowville shows nowhere in outcrop, and in places the Beekmantown and Trenton occur sufficiently close together to show that, if the Lowville occurs here at all, it must be under 5 feet thick. In the Mohawk valley to the eastward, beyond the map limits, it disappears entirely for an interval.

Black river limestone. Normally this formation consists of thick bedded, black, brittle limestone which underlies the Trenton directly. In the Little Falls district it is mostly absent, the Trenton directly following the Lowville. So far as the writer is aware, Prosser was the first to show its presence in the district, he reporting the 5 foot thickness which is shown at Ingham Mills.¹ But just north of the mills, at the second bridge, the old quarry face shows 10 feet of Black river limestone, with the Lowville below and Trenton above, in a vertical 25 foot section [see pl.5]. It consists of 4 to 8 inch layers of black, brittle, blocky limestone separated by shale partings of approximately equal thickness. The limestone bands are like the Black river in lithologic character and in stratigraphic position, and contain fossils rather numerous, so that it will be easy for the paleontologist to determine whether or not it is the normal Black river fauna, as it seems to the writer to be.

¹N. Y. State Mus. Bul. 34, p.469.



H. P. Cushing, photo.

Quarry face at bridge north of Ingham's Mills, showing 10 feet of Lowville (Birdseye) limestone at base, followed by 8 feet of thin black limestone bands with shale partings, of Black river age, and capped by 5 feet of Trenton limestone.

A thickness of 4 feet of black limestone with shale partings, quite like that at Ingham Mills, is exposed $\frac{1}{2}$ mile to the southeast at the brook and road crossing near the east edge of the map. The Trenton appears directly above, but the full thickness and the Lowville below do not show.

Away from the vicinity of Ingham Mills the formation has been noted at but one locality within the map limits. By the road from Diamond hill to Gray, nearly 4 miles beyond, and slightly to the west of north of Diamond hill, the Lowville limestone is shown and capped by a 3 foot thickness of solid, black limestone with the Black river character and fauna. The summit does not show.

All the other contacts within the map limits, and they are many, show the Trenton resting directly on the Lowville, with the exception of one a mile north of Middleville, which discloses a thickness of 1 foot of black, calcareous shale between the two. We have therefore nearly as marked evidence of irregularity and interruption of deposition above the Lowville as there is below. There is to be added to this also as significant, the variation in thickness of the Lowville itself, and the fact that the nearly complete lack of a marine fauna in it would likely indicate local and restricted deposition conditions, rather than those of the open sea. The marine fauna would certainly have been preserved in the rock had it been there.

Trenton limestone. The larger part of the thickness of the Trenton within the map limits is constituted of a gray, thin bedded, semicrystalline limestone, often a mass of fossils or of fossil fragments, locally called shell rock. With this are layers of dark blue limestone, sometimes rather massive but oftener thin, and with a shaly tendency. These are sometimes very full of fossils also, but usually contain them much more sparingly than do the gray beds. In general the gray beds are more prominent in the lower, and the dark blue in the upper part of the formation.

Upward, the gray layers die out entirely, and the limestones are succeeded by a considerable thickness of alternate limestone and shale bands of blue black color, which form a lithologic transition

zone between the Trenton limestone below and the Utica shale above. The limestone bands range from 3 to 18 inches in thickness, and the rock is hard and brittle and quite like the dark blue beds of the Trenton. The shale partings are of blue black shale quite like the Utica above. There is a diminution in amount of limestone and increase in that of shale upward, but on the whole a pretty constant and rapid alternation of the two, continuing through a vertical interval which varies from 25 to 100 feet in thickness, thickest on the west and thinnest on the east.

Lithologically these beds are no more Trenton than they are Utica but are distinctly intermediate in character, and no more to be classed with the one formation than with the other. There is some little shale in the Trenton below, and some rather calcareous beds in the Utica above, but not in sufficient quantity to characterize the formation in either case. Whether the contained fossil fauna would ally the transition beds more distinctly with the underlying or the overlying formation, the writer is not qualified to determine, though strongly of the opinion that the fauna is equally a transition one. Apparently these beds have been classed with the Utica heretofore.

Most of the limestone bands of these passage beds are fossiliferous only sparingly or not at all, but some contain fossils in considerable numbers, and search in the shales will nearly always bring them to light. In the basal portion are some very fossiliferous, black limestone bands which seem unmistakably Trenton.

The best exposures of the Trenton limestone within the map limits are shown in the brooks tributary to West Canada creek from Middleville south. Stony creek, coming in from the east at the county house, shows the best section, comprising the upper portion of the Beekmantown, the entire Lowville which is 15 feet thick here, followed by an unbroken section of 100 feet of Trenton. For $\frac{1}{2}$ mile the fall of the creek is very rapid and most of the section is comprised within that limit. Above, the stream is flowing down the dip for the most part, and the rock thickness passed through in the remaining $\frac{3}{4}$ mile of exposures is not great. The section ends at or near the base of the passage beds, and

above are no rock exposures for 2 miles, when Utica shale appears at an altitude 300 feet higher.

The two brooks which come down from the west, the one just above, and the other just below the county house, show the upper part of the section and the contact between the passage beds and the Utica, though their sections are much more interrupted by breaks than is that of Stony creek. The combined section of the three creeks shows a thickness of about 100 feet of Trenton and an equal thickness of the passage beds, or 200 feet in all between the Lowville and the Utica.

There are also most excellent Trenton exposures along East Canada creek, the best being just above Ingham Mills, where the full thickness is shown in a cliff face which is unfortunately most inaccessible even at low water, since the full volume of the stream hugs that bank. A mile farther up stream it again shows magnificently, being brought up by a low fold, but here the base is not reached and the summit is cut off by a fault which crosses the creek.¹ Up the little brook, above the Black river limestone locality already referred to southeast of Ingham Mills, an uninterrupted thickness of nearly or quite 40 feet of Trenton appears, overlying the Black river. The Trenton hereabouts is nearly or quite 50 feet thick, and the passage beds have a nearly equal thickness. This is somewhat less than half the thickness shown along West Canada creek, and the many exposures elsewhere indicate a progressive thinning of the formation eastward.

From 13 to 15 miles northwest from Middleville are the noted Trenton falls and gorge along West Canada creek. Here the Trenton has a measured thickness of 270 feet, with neither the base nor summit exposed, so that the true thickness is an unknown, but likely small amount in excess of that figure.² The same distance to the southeast from Ingham Mills, down the Mohawk at Canajoharie, the thickness has diminished to 17 feet, [plate 10], is lithologically rather like the rocks here classed as passage beds, and the lower part of the Utica seems to have some-

¹Clarke, J. M. U. S. N. Y. Handbook 15, p.61.

²Prosser. N. Y. State Geol. 15th An. Rept. 1895, p.626.

what the same character.¹ So it is evident that the thinning of the Trenton eastward across the territory included in the map sheet, is only a local exhibition of a more widely extended feature.

Ripple marks in the Trenton. A mile above the mouth of the creek which empties into West Canada from the east 2 miles above Middleville is an interesting exhibition of ripple marks, interesting because of their comparative rarity in limestone formations. The Trenton section up this creek is a very interesting and complete one. The ripple-marked horizon is about 100 feet above the base of the Trenton and in slaty limestones which approach the passage beds in character. The stratum has a slight westerly dip and the creek flows down the dip for several rods, so that the rippled surface is widely exposed. The crests of the ripples are from 9 to 15 inches apart, so that they are considerably broader than the usual ripple marks in sandstones, and the troughs are depressed from 1 to 3 inches below the crests. They run nearly at right angles to the course of the stream, which is thus flowing down a gently inclined, corrugated surface. There results from this a number of little, local eddies in the water, which are strongest in the lowest sags of the troughs. Here the water is beaten up into foam, forming globular masses up to 6 inches in diameter, which rotate in the eddying water and give a very striking appearance to the stream. Varying dip brings this layer to daylight again some 50 rods farther up stream. Not far beneath is a knobby, black limestone layer, full of nodules of chert, containing much pyrite (marcasite), and holding a great number of specimens of a single species of fossil (*Orthoceras*).

Utica shale. This formation consists throughout of black, or blue black, somewhat carbonaceous, fine mud shale. It is mostly very thin splitting (or fissile), this being specially true above. In the lower portion more solid bands are not infrequent, and the shale is usually somewhat calcareous, thin bands of slaty limestone being of frequent occurrence in the basal portion, though

¹Prosser. *Op cit* p.638-40.

not constituting the marked feature of the formation that they do in the passage beds.

The overlying Lorraine shales of the Hudson group were not noted anywhere within the map limits, and it is thought that their horizon is nowhere reached. North of the Mohawk only the lower portion of the Utica is exposed, little beyond the lower 200 feet, if any. South of the river, much higher beds are found, and the altitude of the hills in Danube and German Flats at the south line of the map is nearly or quite sufficient to reach the Lorraine horizon. But these hills are heavily drift-covered, and so deeply so that the actual rock exposures beneath are at a horizon considerably below what the altitude of the hill summits would indicate. The highest beds actually seen are in the town of Danube and on the southern edge of the map. The black, slaty shales outcropping here are 500 feet in altitude above the base of the formation which, together with the upper layers of the passage beds, outcrops near Indian Castle. Since, in addition, the former are 2 miles west of the latter, and since the dips are low to the southwest, these beds must be somewhat over 500 feet above the base of the formation and are likely not far from its summit. The actual summit of the hill on the side of which this outcrop appears, is 200 feet higher, but it is a moraine knob on which the drift is so heavy that all rock is deeply buried beneath. The thickness of Utica shale shown in the Campbell well near Utica is given as 710 feet by Mr C. D. Walcott.¹ It may be thicker or thinner here but is certainly close to 600 feet, exclusive of the passage beds and with the summit not reached.

STRUCTURAL GEOLOGY

Dip

The Paleozoic rocks were originally deposited as nearly horizontal sheets, though with a probable slight inclination to the south or southwest. Oscillations of level in the region since that time have given the rocks a somewhat greater tilt in the same direction, the rocks have been slightly folded also, causing local

¹Am. Ass'n Adv. Sci. Proc. 36:211-12.

variations from the general direction of dip, and they have also been faulted, producing again local variations, which are most marked near the fault lines.

The general direction of dip in the immediate district is to the southwest. The amount is variable though seldom exceeding 5° , and the general average is much less than this. The steeper southwest dips are counteracted by occasional changes of dip to the northwest, because of slight folding. The average dip can only be obtained by bringing large distances into consideration. For example, just east of Middleville the summit of the Beekmantown (the most convenient horizon for the purpose) lies at an altitude of 800 feet above sea level. In the deep well at Ilion, approximately 10 miles distant in a direction somewhat to the west of south, the same horizon was reached at a depth of 630 feet below the mouth of the well, or 225 feet below sea level, an altitude 1025 feet lower than at Middleville and amounting to a fall of somewhat over 100 feet to the mile. This represents a dip not greatly in excess of 1° in this direction. It is quite possible that this is not along the line of greatest dip, that running somewhat more to the westward, but it is exceedingly unlikely that the general dip exceeds 2° .

In the near vicinity of faults steep dips have often been produced by the drag of the rock masses on each side of the fault plane as they have moved past one another during the faulting, the layers being bent upward on the downthrow, and downward on the upthrow side of the fault. The less massive and rigid rocks are, the more they yield to this drag, and hence its effects are in general more pronounced on shales. The Utica shales have thus been given very steep dips near the fault lines of the district, being found with inclinations of 50° to 60° and even more. Such steeply dipping shales show magnificently in the east bank of East Canada creek, just below the Dolgeville power house [pl.8]. They are also well shown in some of the small creeks which cross the Little Falls fault line to the east and northeast of Little Falls.

Folds

Since the rocks dip to the south and west, it follows that they rise in altitude going north. In mapping the formation boundaries it was soon discovered that the rise was not regular, but that a given rock horizon would remain at approximately the same altitude for a distance, then rise rather suddenly to a greater altitude, which was then held for a time, to be followed by another sudden rise. The sudden rises are indicative of rather steep (5°) southerly dips, followed by very flat dips which may be either southerly or northerly. These changes are plainly shown in the topography also, as will appear later. They are most marked in the near vicinity of the faults and are perhaps somewhat involved with them, but they are by no means confined to such situation.

About Middleville the dips bring out the fact that there has been a doming up of the rocks into a low arch there, in the center of which erosion has cut down to the pre-Cambrian. Southward from Middleville the Beekmantown-Lowville contact drops in altitude at the rate of about 100 feet to the mile. Northward from Middleville the northwest dips carry it down in that direction also, though much less rapidly, only about 20 feet to the mile. Three or four miles to the north, these are again replaced by the steeper southwest dips, and the contact rises in altitude. Here is therefore an instance of precisely the same sort of gentle folding that is in evidence along the fault lines.

In East Canada creek the same sort of thing is well brought out. At Ingham Mills the Beekmantown is exposed in the creek bed, with the Lowville, Black river and Trenton above. Just north of Ingham a rather steep northwest dip sends the four formations in rapid succession below the creek level. Sixty rods farther north, changed dip brings the Trenton again to the surface, and it so continues to the fault line, forming a low arch, since the dip changes again to the northwest before the fault is reached.

So far as observed, the axes of all these folds trend from east and west to northeast and southwest and pitch to the west and

southwest. In nearly all cases the southern limb is steeper than the northern, the fold in East Canada creek just north of Ingham Mills being an exception.

In addition to these larger folds, small ones appear in many localities. These are best shown and most conspicuous in the Lowville limestone, though by no means confined to that formation. Such folds are beautifully exhibited in the creeks about Middleville, many of which flow down their westerly pitching sags. Plate 6 shows most excellently these slight folds as seen in the quarry in the Lowville limestone at Ingham Mills; but they show almost equally well in a great number of localities and seem as characteristic of the rocks hereabouts as are the larger folds.

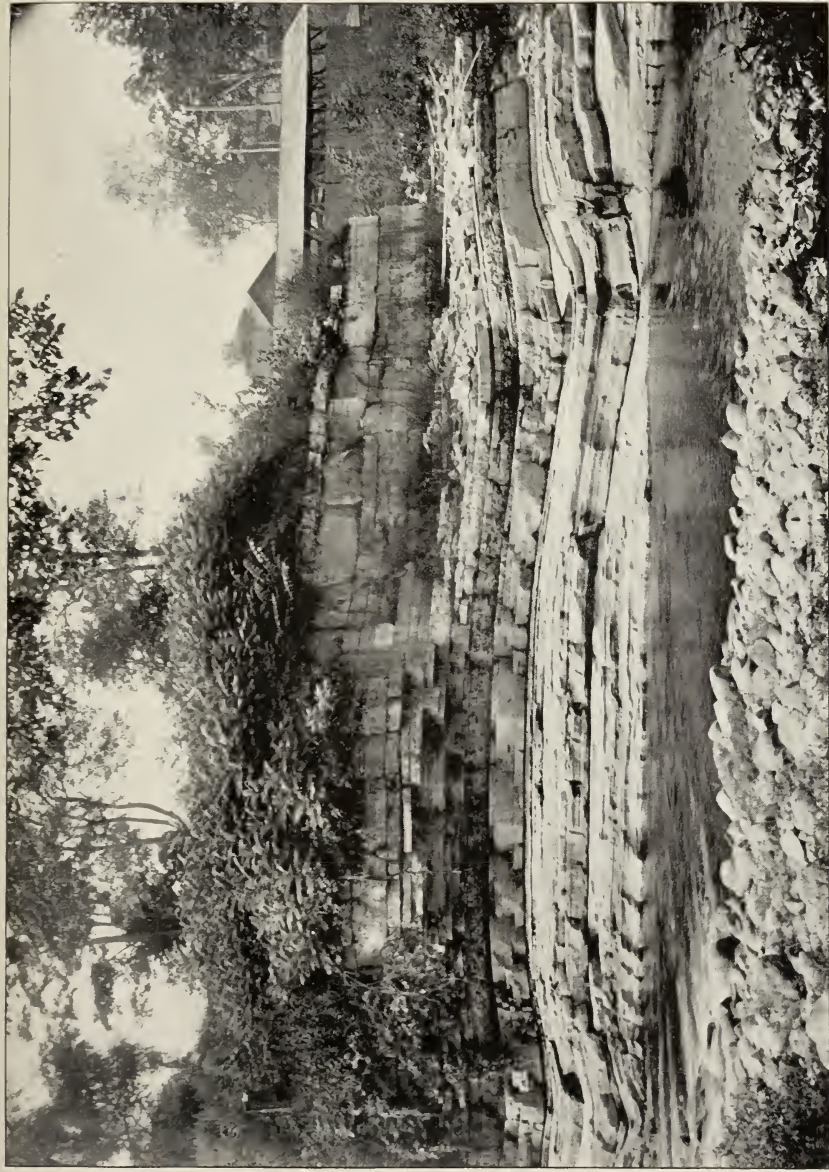
Faults

The Little Falls fault is the most westerly of a series of large, north-south breaks which cross the Mohawk valley, and is the only great fault within the map limits. The Dolgeville fault is of a lower order of magnitude, though still a considerable break. The Manheim fault (of the same order as the Dolgeville) lies just outside the map limits to the east. The second fault at Little Falls is a small affair and likely simply a branch of the main fault, which is very irregular and certainly branches somewhat, to the northward of Little Falls. Three other quite insignificant faults have been detected by the writer, and quite likely others exist. It seems very unlikely that the Little Falls fault marks the westerly limit of faulting. White has in fact noted two faults in the Trenton Falls district in addition to the one noted by Vanuxem, and quite likely others will be forthcoming when detailed mapping is carried northwestward.¹

Little Falls fault. This fault was long ago described by Vanuxem, and recently in more detail by Darton. The latter was without an accurate base map on which to plot his results, and also lacked our present knowledge of the thickness of the various formations of the district, which is so largely due to Prosser's ex-

¹Vanuxem, L. Geol. N. Y. 3d Dist. p.51-54.

White, T. G. N. Y. Acad. Sci. Trans. 15:80-81.



H. P. Cushing, photo.

Folds in the Lowville (Birdseye) limestone at Ingham's Mills. The basal layer is of Beekmantown age and the thin upper layer is Trenton, the Black River being absent. The folds have a low pitch to the s. w. A similar photograph might be taken at numerous other localities in the district, the low folds being characteristic of the region.

cellent work. There is therefore much in the way of details to be added to his description.

South of the Mohawk the topography gives no aid in the location of the fault line, as is the case at, and north of, the river. It has been traced for only some 3 miles in this direction, though it ought to be traceable beyond the map limits provided rock outcrops are forthcoming in that direction. Where last seen, its throw is sufficiently large to guarantee that it must extend some distance farther south.

North of the river the fault can be followed with great accuracy for 3 miles, both as a topographic feature and because of abundant rock outcrops. The actual fault plane is indeed exposed at several localities. Beyond, the topography locates it for 4 miles more, though there is a great scarcity of rock exposures on the downthrow side. Still beyond, up to the point where it passes beyond the limits of the map, its position can not be accurately located, since outcrops wholly fail on the downthrow side, the drift covering is very heavy on both sides, and the topography gives little assistance. Darton has mapped it for some distance farther, but the writer has not been over the ground.

The fault plane approaches verticality, and the downthrow is to the east [*see accompanying maps and sections*]. Darton estimated the throw of the fault at 310 feet, which is accurate for the spot where the measurement was made, but the place proves to have been unfortunately chosen, as will shortly appear. Prosser's accurately measured section at Little Falls furnishes the necessary data for estimating the throw there. The pre-Cambrian rocks are at the surface west of, and the Utica shales east of the fault line. The entire Beekmantown and Trenton, approximating 550 feet in thickness, are thrown out. In addition, the pre-Cambrian rocks rise to 200 feet above the river level at the fault line, while the Utica shale is at the river level on the east side, so that this 200 feet must be added to the other, giving 750 feet. In addition again an unknown thickness of Utica shale must be added. The Utica is heavily dragged upward near the fault, and, to obtain the actual throw, it should be flattened out. Two miles east of the

fault plane, the upper portion of the Trenton-Utica passage beds is exposed near the mouth of Crum creek, at an elevation of 80 feet above the river, and on the south side, at Indian Castle, the same rocks show only 30 feet above the river level, with the Utica outcropping close at hand and only 20 feet higher up. The westerly dip would carry these rocks down to, and slightly below, the river level before reaching the fault line. Hence it is inferred that no great thickness of Utica shale, say 100 feet as a maximum, can be involved east of the fault line, and that therefore the throw of the fault at Little Falls is certainly as much as 750 feet, and lies somewhere between that figure and 850 feet.

South of the Mohawk, after climbing the hill, the Trenton and then the passage beds are at the surface on the west, and the Utica shales on the east of the fault. Since, however, the Utica is at the river level on the east side, since the altitude here is from 500 to 600 feet above the river, and since the dip is to the south about 100 feet to the mile, the horizon in the Utica must be in the neighborhood of from 650 to 700 feet above the base of the formation, so that the throw has not greatly diminished in this direction if it has at all.

The fault plane crosses the river with an approximately northeast and southwest trend. Within the first mile north of the river it swerves somewhat to the north, and then curves sharply westward through an angle of nearly 90° , continuing in this new direction for a mile, when it again swerves to the northward at a sharp angle. In this westwardly trending portion the fault is not a single sharp break as heretofore, but shows Utica shale on the downthrow, and Beekmantown rocks on the upthrow side, with a zone of much shattered Trenton between, having a varying breadth of from 100 to 300 yards; in other words, the fault is doubled through this part of its course with an intermediate shattered zone of no great breadth.

The accompanying section [fig. 5 *a*], made along the road which crosses the fault line midway in this part of its course, shows the usual conditions, though with less minor breakage than usual. Just to the west of the road in the fields, displaced blocks of the

Lowville and Trenton appear, close to the more southerly branch of the fault, with a nearly or quite vertical dip. Figure 5*b*, shows the conditions at this point. A few yards farther west there is exposed a rubble zone composed of broken up fragments of Beekmantown, Lowville and Trenton limestone, with an exposed width of 20 feet, which marks the fault plane of the south branch of the fault, the flat Beekmantown showing directly to the south, but no rock shows just to the north of the rubble zone.

The throw of the fault here can only be conjectured. The entire Trenton and passage beds are thrown out, together with

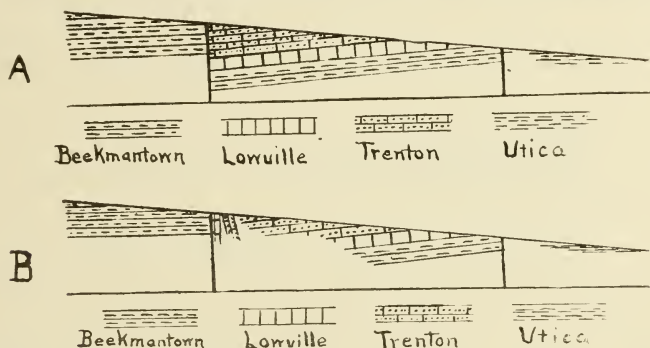


Fig. 5 Sections across the Little Falls fault. Scale, 75 yd=1 in.

unknown amounts of the Beekmantown and Utica. The exposed Beekmantown at the south is however very near the summit of the formation, so that no large amount of it is involved. On the dropped side the exposed Utica would also seem to be near the base of the formation, since the upper passage beds are exposed not far away. The throw would therefore seem not to exceed 300 feet here. This greatly diminished throw in a distance comparatively so short, coupled with the fact that still farther north the throw is approximately the same as at Little Falls, leads the writer to conjecture that quite likely the fault branches at the turn, and that this branch has remained undetected, owing to scarcity of outcrops. That the fault should suddenly diminish so greatly in magnitude, and then shortly reach again its former importance, might perhaps be brought about by its change in direction, but this would seem to be very unlikely.

At the second turn, where the fault swerves again to the north, a little brook crosses the fault line and exposes the very excellent section shown in figure 6, Utica shales, with gradually increasing dip due to drag, appear on the dropped side, the dip rising to 60° near the fault plane. Just at the fault a small block of black limestone like that of the passage beds appears with vertical dip, and then flat lying layers of the Trenton appear, beyond which nearly the full thickness of that formation and the overlying passage beds is shown. The throw here is even less than in the previous case, quite certainly under 300 feet, emphasizing the probable presence of an undetected branch fault. If such be not present, the throw of the fault has diminished two

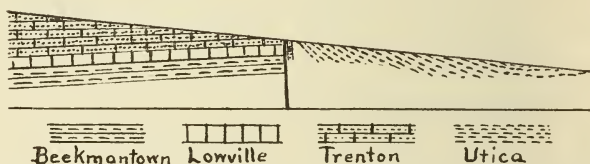


Fig. 6 Section across the Little Falls fault. Scale, 200 yd=1 in.

thirds in amount, and yet rapidly increases to the northward from this point up to its original size.

The trend of the small fault at Little Falls would carry it into the main fault at this corner, provided it extends so far. But the throw of this fault is very slight at best, so that it can not be traced beyond the river, and the junction is simply inferred.

Nearly 1 mile north of this locality a second fault appears, which seems clearly a branch of the main fault, though its actual point of union with that cannot be located. For a distance of a half mile (to the "Gulf" and a little beyond) the two faults can be traced, running nearly parallel for most of the distance, and giving rise to the apparent rock confusion at the "Gulf," which Darton seems to have interpreted as due to the depth of the stream cutting¹. One of the sections of the structure section sheet map crosses the fault at this point and shows the writer's conception of the conditions. Darton's measurement of the throw

¹N. Y. State Geol. 14th An. Rep't. 1894. p.37 and map opposite p.32.

of the fault (310 feet) was made here, and is accurate for the one fault, whose throw is just the thickness of the Beekmantown here, approximately 300 feet. But the real throw here is the combined throw of the two faults, and the second fault throws out the entire Trenton, the passage beds, and an unknown amount of the Utica, so that in the writer's judgment its throw is equal to, or exceeds that of the main fault, as from 100 to 200 feet of the Utica seem clearly to be involved. If that estimate be correct, the combined throw of the two faults here gives a total which does not fall far short of the throw of the single fault east of Little Falls.

One mile farther north the pre-Cambrian rocks appear at the surface from beneath the Beekmantown on the upthrow side of the fault, and thence northward are continuously at the surface on that side. The Utica is the surface rock on the other, but does not show in outcrop anywhere near the fault line. The more northerly of the sections of the structure section sheet crosses the fault line hereabout. The throw of the fault here is somewhat conjectural, since the amount of Utica involved is unknown. The Beekmantown has thinned to only about half the thickness present at Little Falls, but the Trenton and passage beds seem somewhat thicker here than there, though outcrops do not suffice for any precise measurement of their thickness. The horizon in the Utica would seem certainly higher than at Little Falls. It is thought that this, with the thicker Trenton, will largely make up for the diminished Beekmantown thickness, so that, while the throw here may be 100 feet less than at Little Falls, that is an outside limit.

All along this part of its course the absence of outcrops on the east side of the fault makes it impossible to determine whether the fault branches or consists of a single break, though in the absence of any evidence to the contrary the latter is regarded as most probable.

Dolgeville fault. This fault can be traced for only $1\frac{1}{2}$ miles, beyond which its farther extent in both directions is concealed by heavy drift deposits. To the south it must soon disappear because

its throw is reduced to zero. Followed northward from its first point of appearance, its throw increases with unusual rapidity, as noted by Darton.¹ The last point of identification is at the High falls, below Dolgeville, beyond which it can not be traced because of utter lack of outcrops for several miles.

Where the fault crosses the creek, its most southerly point of exposure, the creek has a rock bottom, and the section furnishes interesting evidence of the manner in which the fault is dying out. The dips are rather high, from 30° to 60° on the downthrow side, and the layers have been beveled to an even surface by the cutting action of the stream, so that at low water the section shows mag-

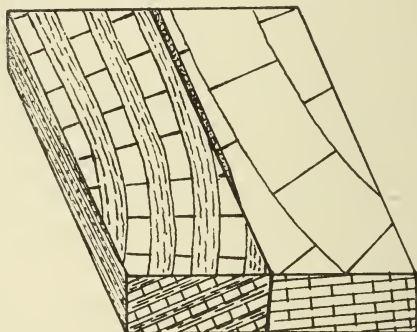
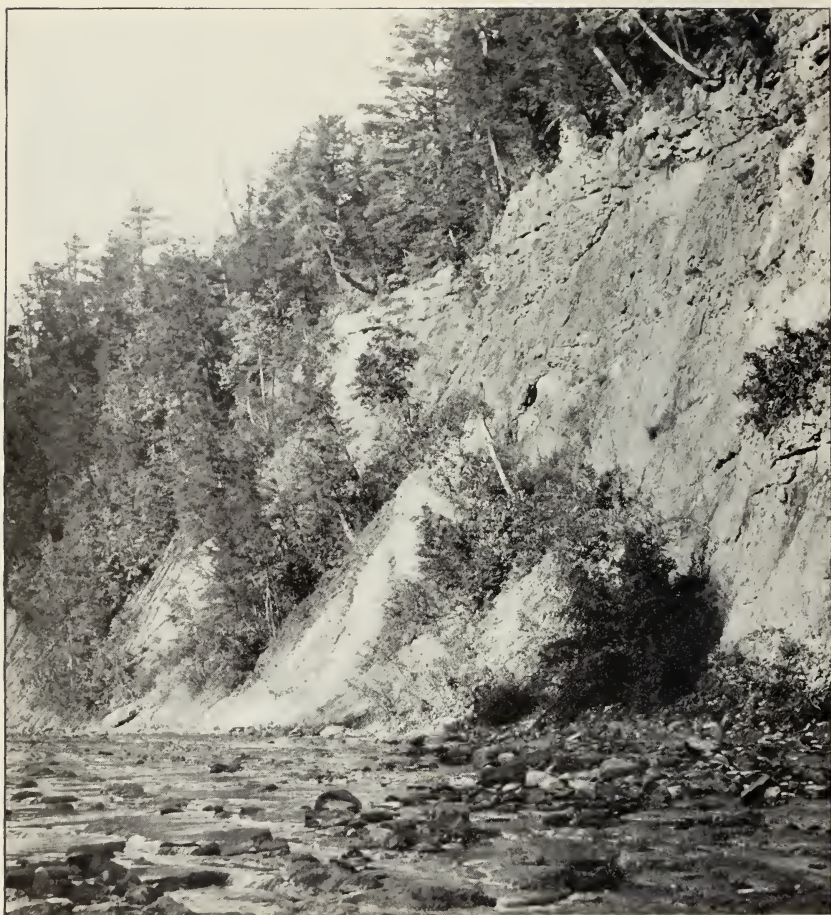


Fig. 7 Plan and section to illustrate the conditions where the Dolgeville fault crosses East Canada creek. Trenton limestone is at the surface on the east side, and the alternate shales and limestones of the passage beds on the west. The divergent strike brings lower beds in succession to the surface on the west, or downthrow side, and higher beds on the east side, with consequent diminution of throw.

nificently. Figure 7, though not an accurate scale drawing, reproduces the observed conditions quite faithfully. There is a breccia zone a few inches wide along the fault line. The spreading produced by swerving of the strike is most marked on the west side, which coupled with the high dip there, brings successively lower layers to the surface with some rapidity. The fault seems to pass into a monoclinal fold southward, which fades out in its turn, and this seems a step in the transition.

Some 50 rods north of this point another smaller fault appears in the east bank of the creek. It shows Utica shale on both sides and has but an insignificant throw. Judging by the

¹Darton gives four sections across this fault, *op. cit.* p.41.



II. P. Cushing, photo.

The Dolgeville fault exposed in the bank of East Canada creek. At the right the fault is at the base of the vertical cliff, which consists entirely of Beekmantown layers, the Lowville capping not showing in the view. Over most of the cliff the fault breccia is still in place, so that the stratification shows only here and there. The fault plane is seen to diagonally ascend the cliff face from right to left, commencing at the dark bush and following the line of bushes. The sloping surfaces below are those of the updragged layers of Utica shale, whose stratification may be made out at the extreme left.

drag, it also throws to the west, as does the main fault, and it is likely a small branch of the latter. It would indicate that the dying out of the fault is probably produced in part by branching.

Between these two points a bend in the creek carries its east bank back against the fault plane, which here forms a nearly perpendicular cliff some 80 feet in high, rising directly from the creek margin. The topographic map is not quite accurate here, so that it is impossible to properly show this feature upon it, an excessive bend and an incorrect course being required to bring the fault to the creek on the map as it stands. The fault plane continues at the margin for only a few yards, then runs diagonally up the cliff face, updragged Utica shale appearing at the base,

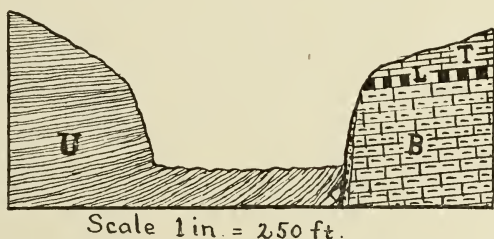


Fig. 8 Section across East Canada creek at the point where the Dolgeville fault forms the east bank. U=Utica shale, T=Trenton limestone, L=Lowville limestone and B=the Beekmantown beds. The fault breccia is also shown. The section crosses the east wall at the right in plate 6.

and running constantly higher, till it forms the entire height of the cliff. The features are magnificently shown, but are unfortunately difficult to photograph satisfactorily, plate 7 showing them as well as it is possible to bring them out. Figure 8 gives a scale drawing of the section here. A fault breccia from 2 to 5 feet wide, consisting of a multitude of angular fragments of all sizes, in which Beekmantown material largely predominates, but with a considerable contribution from the Lowville and Trenton also, embedded in a black, fine grained matrix, which seems largely of Utica origin, occurs here. There is a layer of chert near the summit of the Beekmantown here, as elsewhere, and this has naturally been a large contributor to the breccia. It has been also largely impregnated with pyrite or marcasite, which forms at times nearly the entire matrix, and whose decomposition and oxidation

has blotched the cliff with iron stain. The summit layers of the Beekmantown are also much more pyritiferous than usual. The fault breccia still clings to much of the cliff face, and since the fault plane is nearly vertical, having only the slightest possible inclination westward, it appears much like a vertical dike along the cliff wall.

About 75 feet thickness of Beekmantown rocks is exposed in the cliff above the creek level, while lower Utica appears at that level on the opposite side of the fault; hence the throw comprises that thickness of the Beekmantown, the entire Trenton (inclusive of Lowville and Black river), from 40 to 50 feet thick hereabouts, and an unknown amount of the passage beds and lower Utica, of no great thickness however. The throw is therefore in the neighborhood of 150 feet, while $\frac{1}{4}$ mile to the south, where the fault crosses the creek it will not much exceed 25 feet.

From this point northward to the Dolgeville power plant, at the High falls, a distance of about a mile, the fault runs parallel with the creek and not far distant from it, with steeply updragged Utica shales forming the easterly wall of the gorge. These show beautifully at the power plant [pl. 8 and 9]. A short distance to the east is an old quarry in the Beekmantown at a level 140 feet above the creek bed below the fall. Moreover this is not the summit of the Beekmantown though the actual horizon is unknown. More than this thickness of this formation is therefore involved in the fault here, along with the entire Trenton and passage beds, and an unknown, but here considerable amount of the Utica, the throw here being certainly as much as 300 feet and likely more. The increase in throw has therefore been maintained northward, though apparently at a somewhat less rapid rate than at first.

Beyond this point the creek swerves away from the fault, which becomes wholly lost in heavily drift-filled country.

One mile above Dolgeville a small fault shows in East Canada creek just at the second big bend beyond the village. The fault is in the Utica shales though the associated thin limestone bands indicate that the horizon is not far above the passage beds. The



H. P. Cushing, photo.

Utica shale, east bank of East Canada creek, at the power house near Dolgeville. The steep dip is due to updrag of the Dolgeville fault. It shows best in the left center. The tipping has made one of the joint sets horizontal, and these horizontal joints simulate bedding on the right. The joints are therefore older than the faults.



H. P. Cushing, photo.

Fall in East Canada creek at the power house near Dolgeville. The cliff shown in plate 8 forms the right wall of the gorge just below the fall. The shale here is therefore a little farther away from the fault. The dip still shows the effect of drag, and in increasing amount from left to right, becoming suddenly much steeper at the extreme right.

fault is a small one of unknown throw, at the crest of a low anticlinal fold, with sharp drag on the east side. It is a fair sample of the insignificant faults of the vicinity.

All the Mohawk valley faults, so far as known are normal faults with nearly vertical hade. Nearly all of them downthrow to the east, the only exceptions to this rule known in the region being two of the faults which occur here, the Dolgeville, and the small fault at Little Falls. These both downthrow to the west.

Foliation

The excessive metamorphism to which the pre-Cambrian rocks were early subjected has produced in them a foliated structure, in a varying degree of perfection; varying not only with change in the character of the rock, but from place to place in the same rock. Igneous and aqueous rocks are alike foliated, though commonly the latter are much more distinctly so than the former. The old bedding planes of the aqueous rocks are so obliterated that they have not been made out and it can not be stated what relationship, if any, they bear to the foliation planes. Of the old igneous rocks the syenite at Middleville shows the least foliation of any. The corresponding rock at Little Falls is however excessively foliated, though varying much in amount from place to place. The syenites and granites to the northward are thoroughly gneissoid.

The foliation planes of the district have a nearly east and west strike. Of the very large number of readings taken on them about 65% lie between $n. 70^{\circ} e.$ and $n. 90^{\circ} e.$, and the larger part of the remainder do not exceed these limits by more than 10° . Locally however there is considerable variation, largely due to folding.

The dips of the foliation planes are now to the north, now to the south, showing that they have been folded. Sometimes changes in dip direction are frequent showing small folds, but in the main the folding is on a large scale. In the majority of cases the dips are gentle, not exceeding 20° , but there are many instances of steeper dips, even reaching 90° , and in many places the rocks are excessively and minutely folded and crumpled.

Where the strike swerves to the northwest from its usual direction, the dip is usually found to be to the north, and a corresponding change to the northeast is accompanied by a south dip. Usually a change in dip from north to south is accompanied by a swerving of the strike as above noted, though, where the dips are gentle, the change is apt to be very slight. But, so far as it goes, the evidence indicates a general pitch of the folds to the east.

Joints

Pre-Cambrian rocks. The pre-Cambrian rocks are invariably much jointed. The larger number of the joints are vertical, or nearly so, though they may depart from the perpendicular by varying amounts up to as much as 30° . It is an exceedingly difficult matter to reduce these joints to any system, since they show a surprising lack of uniformity in direction. Most individual exposures show vertical joints in only two directions, though sometimes a third, and rarely a fourth is added. While these two directions are tolerably constant locally, they vary widely from place to place. A large number of readings have been taken on these joints, and, when it is considered that the area on the map occupied by these rocks is only some 50 square miles, the great variation that they show in direction is surprising, and it seems almost futile to attempt to reduce them to any system. To illustrate, 129 readings on these joints were so selected as to represent rather uniformly the pre-Cambrian area, the readings rejected being some of those from places where, because of frequent outcrops, many more than the average number were available. These were plotted as shown in figure 9. In general, readings can not be taken closer than within 5° ; and all others have been plotted at the nearest 5° point (33° being made 35° and so on). On this basis there are 36 possible directions of joint planes, and out of these 31 actually occur. Were the joint planes regular in direction, this would imply a great number of joint systems, but the diagram is itself *prima facie* evidence that they are not regular. Moreover at most outcrops but two systems are to be seen, and also at most outcrops one or both sets are actually seen to be very

irregular, and that in two ways; first, the joints are often observed to curve, and second, the various planes of the same system are often far from parallel. Hence the usual imperfect exposures in the woods, which form the larger number of the pre-Cambrian exposures, and which are apt to show only one or two planes of a set, are likely to give widely varying results.

In many of the pre-Cambrian exposures the two sets of joints shown are, the one parallel to, and the other at right angles to the strike of the rocks. The other exposures show joints which do not conform to the strike, one set making an angle of from 15°

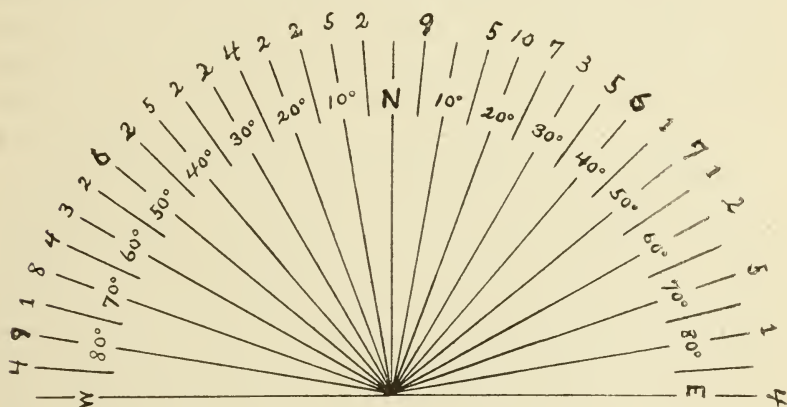


Fig. 9 Diagram of 129 readings on joints in the pre-Cambrian rocks. The inner row of figures represents the points of the compass, in degrees from the true north. The outer row gives the number of readings on joints for each compass direction.

to 45° with it. Sometimes this is brought about by a swerving of the strike while the joints hold their direction, as is the case at Little Falls; at other times it occurs when the strike has remained constant in direction. This latter fact seems to the writer to imply perhaps two groups of rather irregular joints; and the diagram, figure 9, would seem to bear out such an interpretation. Bearing in mind that the curving of the joints causes considerable latitude in the direction of a given set, the diagram shows that the larger number of readings lies between n. 5° e. and n. 25° e. and the next larger number between n. 65° w. and n. 85° w., the two being approximately at right angles. A less well defined group is possibly indicated in the northeast and northwest directions.

The joints in the pre-Cambrian rocks are vastly better shown at Little Falls than at any other locality on the sheet, the steep joint cliffs in the long railway cuts there being familiar to everyone. There are two conspicuous sets of vertical joints here which are at, or nearly at, right angles to each other (the readings show an angle varying between 70° and 90°). Both sets vary somewhat in direction; one gives readings of from n. 70° w. to n. 90° w., the other from n. 20° e. to n. 35° e. There is however a third set to n. 10° w. or thereabouts, which is locally the most conspicuous of all. The strike of the foliation planes at Little Falls varies between n. 60° w. and n. 90° w., being sometimes parallel with, and sometimes making an angle as high as 40° with the n. 50° - 70° w. joint set. This plainly indicates that the variations in direction of joints and foliation are independent of one another.

In addition to the vertical joints, there are at least two sets of much less steeply inclined joints. These are in the majority of cases dip joints, following closely the direction and inclination of the foliation planes. They are most numerous and pronounced in the Grenville gneisses, but occur frequently in the igneous rocks as well, being specially noteworthy in the granitic gneisses associated with the Grenville rocks. The other set is at right angles to the first in regard to both strike and dip, and is not so well marked. Both seem to be compression joints, and the fact that the strike of the second set is at right angles to the foliation strike suggests that the two sets are probably due to compressive forces acting at different times and in opposite directions.

Paleozoic rocks. In these the compression joints are lacking, but the vertical (tension) joints are abundantly developed, and when plotted show the same wide variation in direction found in the pre-Cambrian rocks, so that it is not certain that any set is present in the latter which is not also found in the former. There are however more readings in the direction n. 70° e. than in any other, giving this direction much greater importance than in the pre-Cambrian rocks.

Since the Paleozoic rocks are folded only in the most gentle fashion, the joints have likely no connection with the folding.

Their great irregularity may perhaps indicate that desiccation was a prominent factor in their production. Of these rocks the Utica shales show the most numerous and sharpest joints, and they are least in evidence and most irregular in the Beekmantown rocks. Three sets are often present in the Utica, because of which the harder layers break out into triangular blocks.

Though the fact can not be deduced from a comparison of the readings, it is quite certain that the pre-Cambrian rocks were jointed before the deposition of the paleozoics. The prevailing east-west trend of the diabase dikes, in the regions where these occur, would seem demonstrative of a set of joints having that direction, and suggestive of the probability that that was the only good set.

SOME OSCILLATIONS OF LEVEL DURING THE EARLY PALEOZOIC

Certain matters which are in no sense novel call for consideration here. The main propositions have been already advanced by others. But the detailed study of the Little Falls district has brought out evidence of the verity of certain notions long held which is new, and also the facts can perhaps be marshaled more convincingly than has been the case hitherto.

Paleozoic overlap on the pre-Cambrian floor

It has already been stated that in pre-Paleozoic times the Adirondack region was a dry land area for a vast length of time, and that a subsidence commenced during the Cambrian, in virtue of which the sea slowly encroached on the region from all sides, that it became an island in the midst of the sea, and that by the close of the Lower Silurian the entire region was either entirely submerged or else so nearly so that but little of it still protruded above the waves; that, as it sank, each succeeding rock formation deposited on the floor of the encroaching sea, would extend farther in on the old land surface than the previous one, so that each would be in turn found resting on that surface in going toward its center, constituting what is called overlap. This is in the main the ordinary conception of this portion of the history of the region, and has been specially elaborated by Mr C. D. Wal-

cott, on various occasions. Since Paleozoic deposition ceased in the region, and it became anew a land area, it has been decapitated by the prolonged erosion which has followed. The Paleozoic cover has been entirely worn away from the heart of the Adirondacks, these rocks now appearing as a fringe about the district. In the past they extended farther in than they do now; the erosion of the future will remove them from districts which they now cover, increasing the extent of the area in which the older rocks form the surface exposures. The conditions along the edge of the fringe, so far as they differ, depend not only on

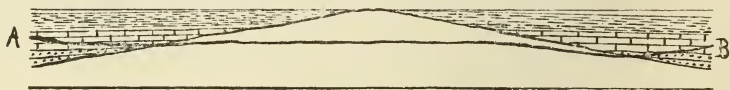


Fig. 10 A reproduction of fig. 3, to illustrate the supposed condition in the Adirondack region at the close of the Utica period. Subsequent erosion has worn off the region down to the line AB, reexposing the pre-Cambrian rocks over a wide area, and leaving the Paleozoic rocks confined to the flanks of the region.

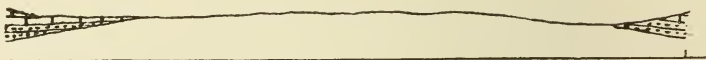


Fig. 11 The region after the wearing away of the upper portion, the line AB of the previous figure forming the surface. Erosion has cut more deeply on the right hand side than on the left. On the right the basal sandstone is exposed, lying unconformably on the old surface, with the overlying limestone appearing farther to the right. On the left the limestone appears lying on the old surface, erosion having nowhere cut deeply enough to expose the underlying sandstone.

possible differences in the conditions of original deposition on different sides of the region, but also on the depth to which erosion has since cut. If we should assume that the Potsdam, Beekmantown, Trenton and Utica formations were successively deposited all about the Adirondacks, progressively overlapping toward the center of the district, then it is theoretically quite possible that we might today find the Potsdam resting on the pre-Cambrian here, the Beekmantown there, and the Trenton or Utica elsewhere, for the reason that more rock had been removed by erosion in the former case than in those following, that in them erosion had not yet cut deeply enough to bring the edge of the Potsdam to daylight from underneath the overlying and overlapping Beekmantown [fig. 10, 11].

Within the map limits the Potsdam sandstone is wholly absent, the Beekmantown resting on the old, pre-Cambrian surface. The

Potsdam may be absent because of overlap, in which case it should be present to the south and west, under cover of the Beekmantown and still later rocks which are at the surface in those directions; or it may be absent because of nondeposition, the subsidence of the region hereabout not having commenced till the close of the Cambrian; or, lastly, it may be absent as a recognizable lithologic formation comparable with the Potsdam sandstone, for the reason that no sand was brought into the upper Cambrian sea here by currents or by streams, a limestone or a shale or both having been deposited instead. The latter alternative can only be determined by the fossils, and in their absence it is impossible to affirm that the basal portion of the Beekmantown may not be of Cambrian age, though it is not probable.

Such evidence as has been brought to light up to the present, is not sufficient to enable us to pronounce affirmatively in favor of any of the above suppositions. One or the other of them must represent the actual facts of the case. Such evidence as is available comes from the deep wells which have been drilled to the west and northwest of the district. Of these there may be specially mentioned the Remington well at Ilion, less than 3 miles west of Herkimer; the Globe mills well at Utica and the Campbell well 3 miles west of Utica; the Rome Brass & Copper Co. well at Rome; and finally the wells in Pulaski and Orwell, Oswego co.¹ These wells were all drilled with churn drills, and the mashed rock fragments produced by this method of drilling are often difficult of proper determination. Had we diamond drill cores from them, the evidence would be all that could be asked. These wells have all begun in, or above, the Utica shale horizon, and have penetrated the entire rock thickness down to, and a varying amount into, the pre-Cambrian. They have gone through the entire rock series here in question, but the fragmental

¹ Prosser, C. S. *Am. Geol.* 25:131-44.

——— *Geol. Soc. Am. Bul.* 4:100-1.

Walcott, C. D. *Am. Ass'n Adv. Sci. Proc.* 36:211-12.

Orton, Edward. *N. Y. State Mus. Bul.* 30, p. 426-50.

samples saved do not suffice properly to identify the rocks. The confusion which exists is in the proper discrimination of the Potsdam from the Beekmantown on the one hand, and from the pre-Cambrian on the other. The basal Beekmantown is often very sandy; and the light colored pre-Cambrian gneisses will furnish a rock powder exceedingly difficult to distinguish from the Potsdam except by the most searching microscopic examination, possibly not even by that. Thus the earlier interpretations of the Globe and Campbell wells assigned from 300 to 400 feet of the rock passed through to the Potsdam. Prosser's later study of the Rome well led him to the belief that the Potsdam was not present there, the Beekmantown resting on the pre-Cambrian, with a total thickness of 475 feet. But the basal 275 feet of the rock referred to the Beekmantown seems not at all calcareous, so that its reference to the Beekmantown is somewhat problematic. Lithologically it certainly does not belong there. On the other hand, as Prosser points out, it is very probable that much, if not all of the rock referred to the Potsdam in the two Utica wells may in reality be pre-Cambrian.¹

As might reasonably be expected, the Ilion well exhibits a section very like the surface section at Little Falls. The Beekmantown is a little thicker, but it shows calcareous matter down to its very base, just as it does at Little Falls. Since Ilion and Little Falls show such similar sections, though 9 miles apart, it is exceed-

¹Through the kindness of Professor Cushing, I have had the opportunity of reading the above remarks concerning the Beekmantown limestone in the Rome well. Data obtained after the preparation of my paper on "Gas-well Sections in the Upper Mohawk Valley and Central New York" leads me to accept fully Professor Cushing's conclusions. Of the 475 feet referred to the Calcareous [Beekmantown] formation in the Rome well (*loc. cit.* p.139, 140, 143), I would now refer the upper 190 feet, from 1085 to 1275 feet in depth, to the Beekmantown limestone. The lower 285 feet, from 1275 to 1560 feet, are apparently not calcareous and are composed mainly of quartz sand. It is not improbable that part of this thickness, and perhaps all, belongs in the Potsdam sandstone; but I am inclined to think that it is a difficult matter to say where the line between the Beekmantown and Potsdam formations shall be drawn.

ingly improbable that, in going the 12 miles farther west to Utica, any such thickness of Potsdam as 300 feet could have crept in in the interval. On the other hand, the great thickness of non-calcareous layers which Prosser has included in the Beekmantown in the Rome well, would seem to the writer to indicate that some Potsdam might be present, both at Rome and at Utica. The reference of 285 feet thickness of noncalcareous sandstones to the Beekmantown seems to the writer hardly justifiable. Orton has classed the 475 feet of rock between the Trenton and the pre-Cambrian in the Rome well as Potsdam and Beekmantown (Calciferos), without attempting to draw any line between the two, and this would seem all that we may do safely at present, though there is unquestionably some justification for Prosser's argument, based on the rock thickness, 475 feet being closely the thickness of the Beekmantown at Ilion and Little Falls. If it be all Beekmantown at Rome, the formation has undergone a pronounced lithologic change in the interval.

The Oswego county wells, though many miles distant to the northwest (Pulaski is nearly 40 miles from Utica in that direction), seem to give significant evidence in this connection. Prof. Orton reports 156 feet of sandstone which he calls Potsdam, in the Central Square well between the limestones and the pre-Cambrian; also a 50 foot thickness of similar sandstone in the Parish well. In the Pulaski wells he reports from 40 to 90 feet of rock thickness between the Beekmantown and the pre-Cambrian, the general section being

Beekmantown	.
Greenish sand.....	10-40 feet
Black limestone	20-40 feet
Greenish sand.....	5-10 feet
Pre-Cambrian	

In the Stillwater well there are similar sands with limestone lying on the pre-Cambrian, the limestone being 6 feet thick, with 18 feet of calcareous sandstone below and 25 feet of green and white sandstone above. Fossil fragments occur in the limestone

chips brought up from this stratum, from which its Upper Cambrian age was determined.

These records seem to demonstrate the presence of deposits of Upper Cambrian age in Oswego county, under cover of the newer rocks and at a distance of some 20 miles from the nearest surface pre-Cambrian outcrops to the eastward. They have not been reported in surface outcrops along the pre-Cambrian boundary, the overlying Silurian limestones seeming to lie directly on the pre-Cambrian there. Apparently we have here direct evidence of overlap, and also evidence of a considerable change in the lithologic character of the Upper Cambrian, it being no longer typical Potsdam sandstone. Nor is the formation here of any great thickness, as compared with the Potsdam sandstone of the St Lawrence and Champlain valleys. But in answer to this last, it might be argued that the diminished thickness here was due to overlap, and that sufficiently deep wells located some few miles to the westward of the Oswego county wells might show a greatly increased thickness of Upper Cambrian rocks, and with our present knowledge this argument could not be gainsaid.

In summing up, it may be said that we have in Oswego county good evidence of the presence of the Upper Cambrian horizon, and that it is absent along the pre-Cambrian boundary because of overlap. Along the line from Rome to Little Falls the evidence is not decisive as to the presence of the Upper Cambrian, nor is there any special indication of thickening in the whole series of deposits between the Trenton and the pre-Cambrian, as should be the case were the conditions those of overlap. But there is the possibility that the Potsdam is represented in the Rome and Utica wells, though it is only a possibility and does not enable us to decide definitely whether the Upper Cambrian was ever deposited anywhere within the limits of the upper Mohawk valley or not.

Beekmantown overlap. The uncertainty which exists in regard to conditions hereabout in Potsdam times, ceases with the beginning of Beekmantown deposition. The evidence of Beekmantown overlap is clear and decisive.

The Beekmantown at Little Falls is 450 feet thick. Northward from there, following first the fault line and then the Beekmantown-pre-Cambrian boundary, the thickness gradually diminishes. At Diamond hill it has shrunk to about 100 feet. Beyond that point exposures are not sufficient to determine the amount absolutely, since the base nowhere outcrops. The last Beekmantown exposures seen are located nearly 2 miles south of the north boundary of the map sheet. While the thickness here can only be inferred, it can be safely said that it can not exceed 40 feet, and is likely not over half that amount.

One mile farther to the northwest Trenton limestone and pre-Cambrian gneisses are exposed sufficiently close to one another to almost preclude the possibility of the presence of the Beekmantown. Darton has however mapped it as extending some three or four miles farther to the northward. The writer has not been over the ground in that direction and does not know whether Darton's mapping there is based on actual outcrops or on inference. In either case we are here near the point of disappearance of the Beekmantown, beyond which the Trenton overlaps it on the pre-Cambrian.

There is an exceedingly interesting section at Diamond hill, demonstrating a local overlap of the Beekmantown there, which may be taken as illustrative of the whole process. As has already been stated, there is an exposure of the contact of the Beekmantown on the pre-Cambrian in the bank of Spruce creek at Diamond hill. Here the top of the pre-Cambrian is at an elevation of 1280 feet above sea level. But only a few rods to the northwest is a low knoll, all over which pre-Cambrian rocks are exposed, which reach an elevation of 1360 feet. Plainly we are here dealing with a low pre-Cambrian knob or hillock at least 80 feet in original height, around which the Beekmantown was deposited before overtopping it. Sixty rods west of Spruce creek a little brook comes down which exposes a most interesting section of Beekmantown rocks some 25 feet in thickness. Then follows a gap of 25 yards in which are no exposures, after which are abundant outcrops of pre-Cambrian gneisses, the nearest to the Beekmantown rocks being at least 15 feet above them in elevation. That there is no

fault between the two is attested by the contact in Spruce creek, and by the study of the abundant outcrops on all sides. The Beekmantown rocks are quite sandy, and yet strongly calcareous (or rather dolomitic, effervescing only slightly with cold, but abundantly with hot acid). They contain numerous pebbles, not only of quartz but also of gneiss, identical with the white, quartzose Grenville gneiss of the hill. Moreover, these pebbles are considerably more numerous in the uppermost Beekmantown layers than in those below, for the evident reason that the exposed portions of the lower layers are at a greater distance from the pre-Cambrian rocks than is the case with the upper ones, that is, the pebbles increase in number with approach to the old shore line, as they would be expected to do. The accompanying section, drawn to scale, shows the actual conditions as observed, and also by dotted line the approximate position of the pre-Cambrian slope, the base on which the Beekmantown was deposited. The section seems to the writer to be decisive as to overlap.

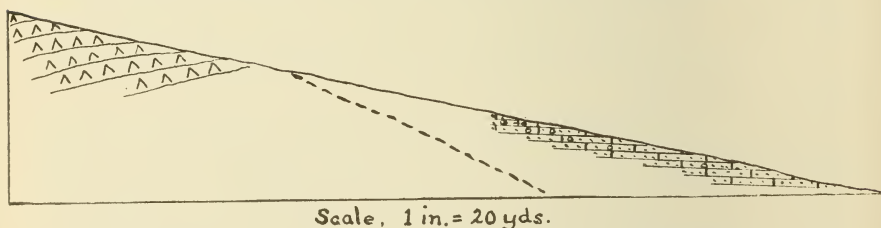


Fig. 12 Section near Diamond hill showing overlap of Beekmantown on pre-Cambrian. The Beekmantown strikes n. 45° w., dip 5° s. The pre-Cambrian rocks strike n. 80° w., with low northerly dip.

This overlap of the Beekmantown denotes a progressive sinking of the immediate district during Beekmantown time. Its successive layers from base to summit must rest in turn on the old rocks, after which the Trenton rests thereon. There is no known locality in northern New York where the Utica may be found resting undisturbed on the old surface, the reason being that erosion has everywhere cut below this horizon and removed every scrap of the Utica from such situation. But there seems no reason to doubt that the progressive subsidence continued intermittently during Lower Silurian time and for an unknown length of time thereafter.

Character and slope of the pre-Cambrian floor

The pre-Cambrian rock exposures of the Little Falls outlier extend for 2 miles in an east and west direction, with a general breadth of a half mile. While the contact with the overlying Beekmantown formation is actually shown in but two places, it is but scantily covered elsewhere, being within a few feet of showing continuously on both sides of the river. The surface on which the Beekmantown rests is surprisingly smooth and even. There are not even minor irregularities in it. For the first mile (between the two faults) it is nearly horizontal, though with slight westward inclination. Beyond the westerly fault it drops to the westward at the rate of 200 feet to the mile up to the point of disappearance beneath the river level. In this western portion the Beekmantown rocks slightly overlap on it, their fall to the west being slightly less rapid. The same may be true of the remainder though it is not certain.

The outlier at Middleville is not sufficiently extensive to afford much evidence in this connection. The creek has here cut down on the summit of a low fold. There is no evidence here of irregularity of original surface, but there is slight opportunity for such evidence.

The small outlier at the "Gulf", $2\frac{1}{2}$ miles northeast of Little Falls, seems to represent the summit of a small knob of the old surface projecting up into the overlying Beekmantown. But it can not be much of a hill at best. The pre-Cambrian surface, at the fault line east of Little Falls, has an altitude of 700 feet; 4 miles to the northward, where it reappears from underneath the Beekmantown rocks to the west of the fault line, its altitude is 1000 feet; the little outlier is midway between the two and is at 860 feet elevation.

Along the main line of contact between the Beekmantown and pre-Cambrian the same evidence of comparative evenness of the rock surface on which Beekmantown deposition took place, is presented. Exposures are not all that could be asked, and at Diamond hill there is evidence of a low hill rising some 100 feet above the general level, that being the greatest irregularity of sur-

face indicated anywhere within the map limits. The surface seems to have been worn down to that of a gently sloping plain, above whose level, occasional low, rounded hills arose.

Though this evidence is meager in amount, and needs corroboration from adjoining districts, it seems specially important in view of the fact that Professors Kemp and Smyth, and the writer also, have found evidence to show that, in the St Lawrence and Champlain valleys and vicinity, the surface on which the Potsdam was deposited was considerably more uneven than this. In other words, the surface on the south was worn down to a nearer approach to base level than was the case farther north.¹ This may be accounted for in part by the fact that, since the Potsdam lies on the old surface there and the Beekmantown here, the surface here was a land area and undergoing wear during Potsdam time, or was a land area longer. The probable length of time involved would however seem insufficient to account for all of the observed difference.

A more probable explanation would seem to be that we are dealing here with a plain of marine erosion, and that its subsidence was slow, giving opportunity for the cutting of a considerable submarine terrace; whereas on the north the rather rapid subsidence during the Potsdam did not permit of the production of such a smooth and well defined bench, the district passing beneath the sea practically as subaerial erosion had left it, except for the removal of the weathered material.

Slope of the surface on which the Beekmantown was deposited. The Beekmantown rocks at Middleville are 200 feet in thickness. Seven miles to the northeast they have nearly or quite disappeared, and the Trenton rocks are overlapping on the pre-Cambrian. The pre-Cambrian surface has risen 800 feet in the interval, while the base of the Trenton has only risen 600 feet, the difference of 200 feet representing roughly the inclination of the surface on which

¹Professor Kemp states in a letter that he has come to the same conclusions about the greater evenness in the south, away from the higher hills of the interior, from observations at the "Noses" and in the southern Hudson-Champlain valley.

deposition was taking place, indicating a slope of nearly 30 feet to the mile.

From Middleville to Ilion, in the opposite direction, the distance is 9 miles. The Beekmantown thickens 275 feet in the distance, from 200 to 475 feet, or again 30 feet to the mile.

From Little Falls northward to the spot of Beekmantown disappearance the distance is 15 miles. The Beekmantown rocks at Little Falls are 450 feet in thickness. This wholly disappears in the 15 miles, indicating again a slope of 30 feet to the mile.

The two latter measurements are both made in a nearly southerly direction and agree very closely. The first measurement is made in a southwesterly direction and falls somewhat short of the other two, which would indicate that the general slope of the surface was to the south. It is not meant to imply that this slope was maintained over any great distance, nor that it was uniform throughout, nor does it follow that the whole thickening to the south is due to overlap. But the figures do seem to demonstrate a southerly sloping sea floor, whose rate of slope was not over 30 feet to the mile, though it may have been somewhat less than that, and which is at least maintained throughout the area covered by the map.

As will be immediately shown there was some disturbance of the district during the early Trenton which must have affected this slope both in direction and in amount. Unfortunately also no quantitative data for determining the amount of this effect are at hand. But the effect could not have been great. If we assume that the effect was nil, and allow the Trenton rocks a thickness of 300 feet, which is close to their maximum hereabouts, then they would have only reached in 10 miles farther on the old surface than the Beekmantown rocks do, if the same rate of slope was maintained, beyond which the Utica would have overlapped on the surface. Nor would the Utica and Lorraine shales of the Hudson formation have extended in more than 30 miles farther over the region, even on the assumption that they were deposited to their full thickness, which is not likely. This line of evidence would therefore, so far as it may be worth anything, seem to indicate that

the southern Adirondack region could not have been completely submerged at the close of the Lower Silurian, much less so at the close of the Trenton. Here again the evidence is rather opposed to that on the north side of the region, as will be shortly shown.

Unconformity at the base of the Trenton

The great thickness of the Trenton formation at Trenton Falls, and its rapid diminution in thickness eastward across the area of the map have already been noted, together with the variation in thickness of the Lowville down to complete absence, the presence of the Black river limestone only here and there, and the fact that the passage beds between the Beekmantown and Lowville are not always present. Vanuxem, Darton and Prosser have all published valuable data along this same line, derived from the Mohawk valley to the eastward. The most significant section is that at Canajoharie, described by all three observers as showing a distinct, though slight, erosion unconformity between the Beekmantown and Trenton [*see* pl. 10, and compare with pl. 5]. Prosser measured but 17 feet of Trenton here, and this seems to represent only the upper beds of the formation, while both the Lowville and Black river are wholly wanting. At Sprakers, 3 miles farther east, Prosser's section shows again but 17 feet of Trenton, with no sign of the Lowville and Black river. Nothing is said about an unconformity at this point and apparently the actual contact is not exposed.

Eastward from Sprakers the Trenton slowly thickens, and the Lowville and Black river limestones reappear. Prosser's numerous and accurately measured sections, published in the 15th Annual Report of the State Geologist, show that all three are usually present, though occasionally either the Lowville or the Black river is lacking, and the combined formation does not regain any special thickness, being always under 50 feet.

From these facts it is evident that the rather steady, progressive subsiding movement which characterized the region during Beekmantown deposition, and which resulted in the rather constant thickness of that formation of from 450 to 550 feet throughout the Mohawk valley (except where thinned by overlap), was



N. H. Darton, photo.

North bank of creek south of Canajoharie N. Y. exhibiting the relations of the Trenton limestone, horizontal Trenton resting unconformably on slightly folded Beekmantown; the Lowville, Black River and lower Trenton being absent

interrupted at the close of the Beekmantown conditions. There is little evidence that the subsiding movement was changed to one of elevation, except locally about Canajoharie, where it would seem that a slight arching of the surface occurred, accompanied by some slight erosion, before the downward movement was resumed late in the Trenton. Otherwise conditions seem best accounted for on the assumption of a check to the downward movement, which was thence forward in very slight amount for a time, with many small local variations. With cessation of subsidence deposition must soon cease and the evidence of local variations is convincing. The field evidence led the writer to the belief in an unconformity at this horizon, before the search through the literature made him aware that others had brought out evidence along the same line.

Absence of the Chazy formation in the Mohawk valley

One effect of this pause in subsidence (with perhaps slight accompanying uplift) was to effect an entire separation between the basin of Mohawk valley deposition and that of the Champlain valley, for the time being. In the latter we have a great formation, the Chazy limestone, with a maximum thickness of 800 feet in Clinton county, interposed between the Beekmantown and the Trenton. This formation rapidly diminishes in thickness when followed to the southward in the Champlain valley and wholly disappears before the Mohawk is reached. Its thinning and disappearance seem to be due to a progressively diminishing rate of subsidence toward the south, rather than to overlap. This point will be again reverted to; and, if well taken, it follows that, while a considerable downward movement, progressively greater toward the north, was taking place in the northern district, little or no subsidence, and hence an almost complete interruption of deposition, characterized the southern region during the time interval represented by Chazy deposition.

Sudden thickening of the Trenton westward

At Trenton Falls the Trenton limestone has a measured thickness of 270 feet, which must be increased by an unknown but small amount, since neither the base nor the summit shows in the sec-

tion there. At Middleville, 13 miles to the southeast from Trenton Falls, the Trenton is only about 100 feet thick, excluding the passage beds but including the Lowville. From Middleville on to Ingham Mills and thence to Canajoharie, the thinning goes on, but much less rapidly. Now unquestionably a portion of this diminution is due to the interruption of subsidence, this interruption being most pronounced at Canajoharie, thence diminishing both eastward and westward, apparently much more rapidly westward. But the writer is strongly impressed with the possibility, nay probability, that it is in part due to a change in the character of the sedimentation going eastward; in other words that the upper portion of the Trenton of the Trenton Falls section passes laterally, by increase in amount of shale and by disappearance of the few heavy limestone layers, into what are here mapped as passage beds. A large part of the upper half of the Trenton at Trenton Falls, judging from the descriptions of Prosser and White, consists of alternating layers of thin limestone and shale containing few fossils, the whole being capped by the heavy, gray, crystalline limestone at Prospect. With a thinning out and disappearance of this upper heavy layer, very slight change in what lies beneath would give it typical passage zone character, and the gradual downward encroachment of this zone might be very effective in thinning the typical Trenton beneath.

Comparison with the northern Adirondacks

In the lower Champlain valley, on the New York side, the Paleozoic section comprises the

Potsdam formation, maximum thickness unknown but	
more than	800
Beekmantown formation, maximum thickness.....	1800
Chazy formation, maximum thickness.....	800
Trenton (including Black river), thickness unknown,	
at least	250
Utica shale, thickness unknown but great	

This section is at least 3000 feet thicker than that of the Mohawk valley, and likely considerably more, the main part of

the excess being in the lower portion of the section. Data as to the slope of the floor on which these rocks were laid down are lacking, though the evidence is clear that it was by no means so even as it is about Little Falls. On the other hand, the surface was by no means so rugged as much of the present Adirondack surface. Yet, with the surface as at present, the thickness of Paleozoic rocks laid down on the north would suffice to blanket the whole region with them, if extended to the south over it. Because of this, the writer has argued in a previous publication that the entire Adirondack region was likely submerged at the close of Utica deposition. Following an entirely different line of argument, Ruedemann has contended for nearly complete submergence *during* the Utica.¹ The evidence on the south seems however somewhat opposed to these conclusions, and at least warrants the statement that any portion of the region which may have remained unsubmerged during or at the close of Utica deposition, was in the southern Adirondacks.

The fact that the deposits of the early Paleozoic are thickest on the northeast, diminishing thence west and south, implies more rapid and more steady subsidence in that part of the region. And the vastly greater quantity of land wash carried into the northern sea indicates that the prevailing drainage of the present Adirondack area was to the north. Along this line may come a propable explanation of the apparently conflicting evidence from the north and the south in regard to the submergence of the district at the close of the Utica.

It seems to argue that the summit of the Adirondack island was toward the southern part of the present region, and if it was not distant more than 30 or 40 miles from the present border it would have become submerged by the close of the Trenton at the estimated rate of overlap.

TOPOGRAPHY

The present topography of the Little Falls district is the result of, and expression of, its long and complicated geologic history. The pre-Cambrian submergence with its deposits, the pre-Cam-

¹Ruedemann, R. Am. Geol. June 1897 and Feb. 1898. p.75.

brian elevation into a land area with its long protracted erosion and its igneous action, the Paleozoic submergence and deposition, and the ensuing and still continuing elevation above sea level, with its erosion, its oscillations of level and its disturbance by faulting, all have their share in the present topography; and, lastly, the recent Glacial period with its advancing and eroding, and its retreating and depositing ice sheets, is entitled to a very large share of responsibility for present conditions.

Pre-Cambrian surface

Evidence as to the character of the pre-Cambrian surface at the close of the long period of pre-Cambrian erosion, has already been presented, and it has also been shown that it is here more nearly a plane surface than is usual in the Adirondack region. The writer is disposed to regard the more even surface here as representing a plain of marine erosion, more even than on the north, because subsidence was less rapid and of a more intermittent character here, so that the action of the waves was longer continued at a given level.

As the district emerged from the sea after the deposition of the Paleozoic rocks, it appeared in all probability as a coastal plain, with gently sloping, quite even surface. The present pre-Cambrian surface exposures are such because the Paleozoic cover has been removed by later erosion. Along the contact line of today we see the pre-Cambrian surface as it was when originally covered by the later rocks. As we recede from that line, the pre-Cambrian rocks have been exposed to progressively longer wear, during which the less durable rocks have lost more than those of greater durability, and more material has been removed from along the stream courses than from the interstream areas; hence the surface is now one of hill and valley. In regard to this present surface two things seem quite clear, first, that the hilltops rise to quite concordant altitudes, with a general increase in elevation to the northward, and second, that the comparatively plane surface which would be produced by filling up the valleys to the level of the hilltops, does not correspond in inclination with

the yet more even surface on which the Paleozoic rocks were laid down. The evidence is in brief as follows:

Examination of the Little Falls topographic sheet shows a progressive rise of the pre-Cambrian hilltops going northward, the highest elevations reached being somewhat over 2000 feet. On the Wilmurt sheet (lying directly north of the Little Falls sheet) the same fairly concordant altitudes are to be noted, and the same slow increase northward, the higher summits in the northern part of that sheet showing elevations slightly over 2500 feet. This is an increase of about 500 feet in 18 miles, or between 25 and 30 feet to the mile. Northward along the western edge of the same sheet the rise is somewhat more rapid, about 50 feet to the mile.

Some idea of the general slope of the pre-Cambrian surface underneath the Paleozoic rocks may be obtained by comparing the altitudes of this surface at Little Falls and at Diamond hill for one line, and from Ilion through Middleville and thence northward for another line.

Diamond hill is 8 miles north of Little Falls. The Spruce creek contact there is at 1200 feet altitude. The pre-Cambrian in the river above Little Falls, taken at that point in order to avoid the lifting effect of the fault as much as possible, is at 400 feet. Thus there is a rise of the pre-Cambrian surface of 800 feet in the 8 miles, or 100 feet to the mile. Since Diamond hill is farther away from the upthrow influence of the fault, this amount is probably a little too small.

In the well at Ilion the pre-Cambrian was reached at 1105 feet, or 700 feet below sea level. At Middleville it is 500 feet above tide, a rise of 1200 feet in between 9 and 10 miles, or about 130 feet to the mile. Ten miles north of Middleville the pre-Cambrian appears from under the Trenton at 1300 feet altitude, a rise of 80 feet to the mile.

While these results are not particularly concordant, and while more data are much to be desired, they do seem to indicate that the one surface falls to the south more rapidly than the other, say from two to three times as rapidly. Both surfaces fall also

to the west, but the north-south direction was chosen in order to avoid the tipping produced by faulting, so far as possible.

Since the erosion level whose presence is indicated by the concordant hilltop altitudes does not correspond with the older erosion plane on which the Paleozoic rocks rest, but makes an angle with it, it follows that it must have been developed during a later erosion period. It follows further that the more we recede from the present Paleozoic contact line, the more deeply erosion has cut away the pre-Cambrian rocks.

The area under discussion is so small, and the writer has so little familiarity with the surrounding district, that it would be folly to attempt to trace the erosion level beyond the district, either north or south. That it represents an old level is quite clear, and that it should also be traceable south of the Mohawk is equally clear. The larger portion of the area of the Little Falls sheet has been cut down by later erosion to a lower level. It should be pointed out, however, that the concordant hilltop altitudes, as found here, are also found in the northwestern Adirondacks, but are not to be found on the east and northeast, because of which the writer has argued for recent movements along the fault planes in the latter district as a probable reason for their absence; that is, that the erosion surface was produced there as on the west and south, but that its continuity has been broken by recent differential movements along the old fault planes.

Present surface of the Paleozoic rocks

As the Little Falls district emerged from the sea after the deposition of the Paleozoic rocks, it presented a low and quite smooth surface, with a gentle inclination to the south or southwest. Since at present the rocks are but slightly tilted from their original nearly horizontal attitude, the original uplift, as well as all others since, has affected their inclination but little. The diagram, figure 13, represents a rude attempt to illustrate the structure of the region on emergence, on the assumption that this took place at the close of deposition of the Medina sandstone of the Upper Silurian. This is in all probability not the case, but

the rocks included are all that are now represented in the immediate district, and the diagram is just as suitable for illustrative purposes as if the higher rocks were added. As the district became a land area, streams would extend themselves across it and commence to wear out valleys, tributaries would develop to these main streams, the topography would become more irregular because of this wear, and the precise sort of irregularity developed depended on certain special characteristics of the district. These were the original south slope of the surface, the gentle inclination of the rocks, the variation in resistance of the different formations, and the fact that the Paleozoic cover was thinner at the north than

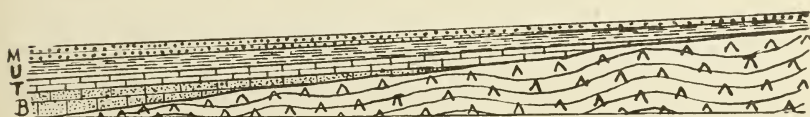


Fig. 13 Diagram to illustrate the condition of the region after deposition of the Paleozoic rocks and emergence above sea level, with smooth, southerly sloping surface. B=Beekmantown, T=Trenton, U=Utica and Hudson shales and M=the Oswego and Medina sandstone formations of the Upper Silurian.



Fig. 14 Diagram to illustrate the topography produced as a result of prolonged erosion on the district shown in figure 13. The erosion stage represented is that of greatest possible relief.

at the south. In figure 14 an attempt is made to indicate the character of the surface produced at a certain stage of the erosive process. The Medina is the most resistant of the Paleozoic rocks included, followed in order by the Beekmantown, Trenton and Utica. The Medina would be first cut through by the streams at the north because of its higher altitude there. Once the softer rocks beneath were exposed, erosion would proceed more rapidly. The pre-Cambrian rocks would be first uncovered on the north, both because of higher altitude and because the Paleozoic cover was thinnest there. This slow removal of the Paleozoic cover would then advance southward. The successive Paleozoic formations would then be found infacing toward the old surface on which they were originally deposited. The harder and more resistant layers would inface as lines of cliff, or escarpment, running

roughly parallel to the old shore line. Such an escarpment would be specially prominent when the underlying rock was very weak. The resistant Medina sandstone, overlying the weak Hudson shales, forms just such a combination, and the Medina escarpment is a prominent feature of the district south of the Mohawk, though lying beyond the limits of the map.

Since the Beekmantown is more resistant than the Trenton, and that more so than the Utica, erosion tends to strip the Trenton from off the Beekmantown more rapidly than the latter can itself be worn back, and thus to leave a bared strip, or terrace formed on the upper surface of the Beekmantown. For a like reason, a terrace tends also to develop on the upper surface of the Trenton as the Utica is worn away, the level of the Trenton terrace dropping rather abruptly to that of the Beekmantown over the low escarpment formed by the edges of the retreating Trenton layers. Likewise a terrace tends to form on the even pre-Cambrian surface bared by the removal of the Beekmantown, since the former rocks are vastly more resistant.

With the district at a given elevation, wear can be carried on only down to a certain level, determined by the slope necessary to permit the streams to carry away their load of rock waste. The soft rocks will be worn down to this level long before the hard rocks reach it. But then wear ceases on the soft rocks while still continuing on the hard. Therefore features of relief produced by varying rate of wear can reach only a certain degree of accentuation, after which the effect of erosion is to diminish their strength, and, if the region persist sufficiently long at the given level, all rocks, hard as well as soft, will be worn down nearly or quite to the level of the stream bottoms. Renewed uplift will however cause the streams to renew down cutting, again the soft rocks will go down first and the hard again come to stand above their level, resulting in a reproduction of the previous features, the only difference being that they will be shifted to the southward of their position in the previous erosion cycle. The amount of relief obtainable in each cycle will also depend on the amount of uplift.

Now this region has been continuously above sea level for a long time, long enough for erosion to have pared away all rocks, hard as well as soft, down close to base level, and this not only once but more likely several times. That the district is not in this leveled condition but has, well developed, the topographic features outlined above, hard rock escarpments, soft rock valleys and terraces, is in itself indicative of renewed uplift, and that of no very remote date.

There appears also to be evidence that, prior to this uplift, the region had persisted sufficiently long at the previous elevation to have become pretty thoroughly worn down. Such evidence of this as exists in the immediate neighborhood is found in the concordant altitudes of the Adirondack hilltops to the north, and the hard rock plateau summits to the south of the Little Falls sheet. But the district in question is not sufficiently covered by the new maps, nor is the writer's personal acquaintance with it sufficiently extensive to warrant more than the simple statement of his belief that the Cretaceous peneplain, recognized as of wide extent over much of the eastern United States, is recognizable in the southwestern Adirondack region.

Influence of the faults on the topography

As newly formed, faults like that at Little Falls produce lines of cliff known as fault scarps along the edge of the upthrown block. Though faulting is a slow process, and though the rising upthrow side is subject to more rapid erosion than the other side because of its greater elevation, so that in all likelihood no fault scarp has ever had a height equal to the amount of the fault's throw, yet newly formed faults should present scarps whose height should represent a very respectable percentage of the amount of throw at least.

As time passes, the greater wear on the upthrow side will cut it down to the level of the other and the scarp will cease to exist. It may be made to reappear in one of two ways: first, by renewed faulting taking place along the same line; second, by renewed uplift of the region without faulting. In the latter case the rock

on one side at the surface is likely to be more resistant than that on the other, and the more rapid wear in the softer rock will again bring the fault into some prominence as a topographic feature, the amount depending on the difference in resistance of the two rocks concerned, and on the amount of uplift.

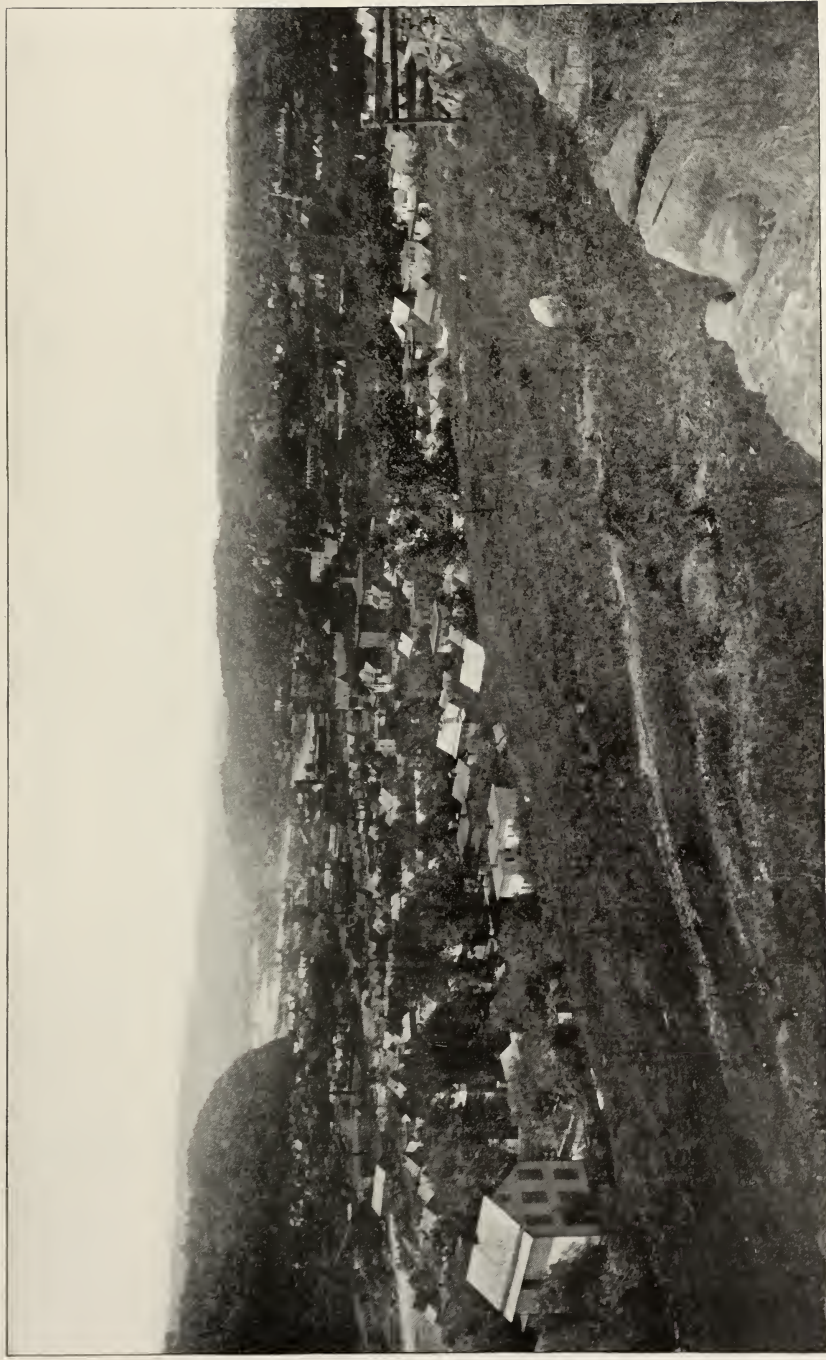
When the faults of the district are examined with these principles in mind, it is at once seen that they are at least sufficiently old, so that the original scarps have been utterly obliterated as topographic features; that no recent slipping has taken place along them; and that such small show as they make in the present topography is due to the rather recent uplift of the region as a whole. The Little Falls fault makes no considerable show in the topography except along the immediate channels of the streams which cross it, all of which show falls or rapids, and gorges below, in the harder rocks of the upthrow side, with sudden change in the character of the valley as the fault line is crossed [*see pl. 11*]. This is most impressively shown along the Mohawk, the broad, mature looking valley developed in the weak Utica shales east of the fault contrasting sharply with the narrow gorge in the resistant rocks west of it, and the fault scarp being a prominent feature when looking up the valley [*see pl. 12, 13*]. Away from the streams, where the fault affects the topography at all, it appears as a low escarpment, with gently sloping instead of steep front, the slope being down the dip of the updragged Utica beds on the downthrow side. Where the very resistant pre-Cambrian rocks are on one side with the Utica shale on the other, the fault is fairly prominent and would be more so were it not for deep drift deposits on the lower side.

The larger faults do, however, have an important indirect effect on the topography. Since they run north-south, and since the uplifting of the west side has given the rocks there a tilt to the westward, in addition to the usual south dip, giving them a local north-south strike, erosion has developed the Beekmantown and Trenton escarpments and terraces there with a north-south trend, at right angles to their usual direction [*see pl. 14*]. The pre-Cambrian terrance is also well developed on the west side of the



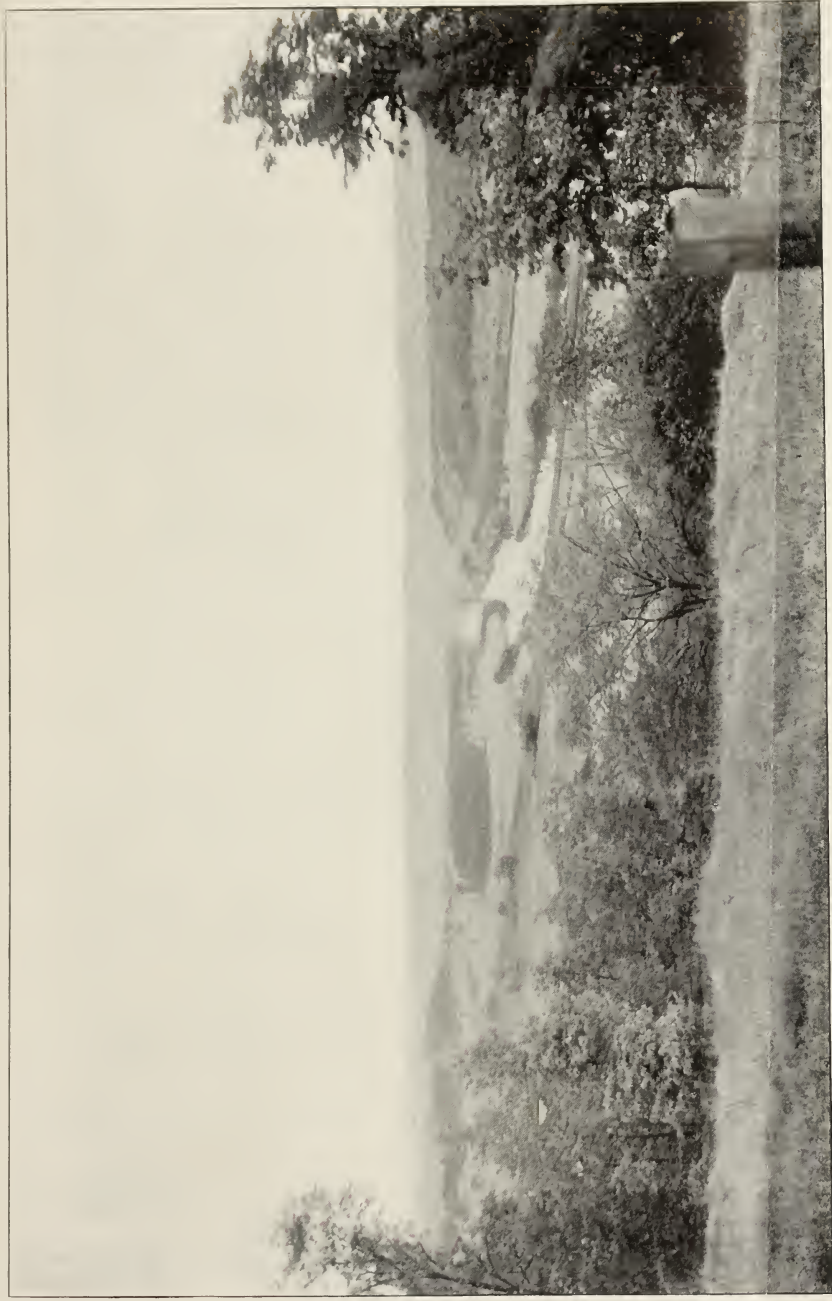
H. P. Cushing, photo.

Fall in creek over the pre-Cambrian at the Little Falls fault line 2 miles west of Dolgeville. The creek is in a postglacial valley, and has only cut back its fall 100 yards from the fault plane, the volume being slight and the rocks very resistant. The perpendicular walls of the gorge below are due to the joint planes, and the large loose blocks are dislodged mainly by frost.



N. H. Darton, photo.

Looking up the Mohawk river from the eastern part of Little Falls. Crystalline rocks in bottom of gorge; cliffs of Beekmantown dolomite in foreground; hills of Utica slate in background



H. P. Cushing, photo.

Looking down the Mohawk from the brink of the Little Falls fault scarp, showing the broadly open character of the valley, as contrasted with its narrow character above shown in plate 12. The fault scarp here is prominent and about 200 feet high, but this prominence is only local and due to the nonresistant character of the rock below the fault line, as compared with that above; so that the river has excavated a broad valley in the former while still working at its gorge in the latter.



H. P. Cushing, photo.

Looking down on the Trenton terrace from the Utica shale slope to the west. Taken from a point 4 miles west of Dolgeville, and looking east

Little Falls fault, in the northern part of the sheet. From this standpoint therefore the large faults do yet exert a large influence on the topography in their vicinity.

PLEISTOCENE (GLACIAL) DEPOSITS

The Pleistocene deposits of the district, and the history which they record, can receive adequate consideration only after a thorough study of a wide area. Brigham has recently published an excellent paper on the "Topography and Glacial Deposits of the Mohawk Valley," containing numerous references to the literature of the subject.¹ The writer has been over such a scant amount of the area that he can add little save some local details to the general discussion.

The amount of glacial erosion in the district does not seem to have been great. The soil and weathered rock were removed and the underlying rock surfaces scoured and polished, but the general topography seems to have been but scantily affected.

Professor Chamberlin has discussed the general ice movement in the Mohawk valley, holding that there was an easterly moving ice tongue in the western portion of the valley, and a westerly moving one in the eastern portion, the two meeting near Little Falls.² His final statement sums up as follows:

I hesitate, at this stage of the inquiry, to encourage any confident opinion in regard to the exact history of glacial movements in the Mohawk valley, further than the general presumption that massive ice currents . . . swept around the Adirondacks and entered the Mohawk valley at either extremity, while a feebler current, at the height of glaciation, probably passed over the Adirondacks and gave to the whole a southerly trend.

The readings of glacial striae which he reports are quite in accord with this view; and with it the writer's similar observations also agree.

Away from the valley the writer has only two observations on striae, not a sufficient number on which to base any deductions. One mile north of Salisbury Centre striae bearing s. 30° e. were

¹Geol. Soc. Am. Bul. 9:183-210.

²Chamberlin, T. C. United States Geol. Sur. 3d An. Rep't. p.361-65.

observed near the summit of a knoll of pre-Cambrian rock. It is not certain whether the movement was to s. 30° e. or to n. 30° w. though in all probability the former.

Near White creek, 2½ miles north of Middleville, one of the tributary creeks just uncovers, in its bed, the summit of a hill capped by Trenton limestone, on which are plentiful striae bearing n. 80° e. Since this is a hill summit, no rock showing in the banks, and none in the bed either above or below, it should give the general ice direction, and accords well with the records nearer the Mohawk.

The only possible criticism to be made on Professor Chamberlin's quoted statement is that it might lead the reader to hold the view that general glaciation in the Adirondacks was not severe and long continued, and such view is certainly erroneous.

In general, the glacial deposits are not exceedingly bulky over the limits of the sheet, and over much of it they are very thin, the underlying rocks not only outcropping along the streams but repeatedly in the interstream areas. The drift is heaviest in the northwestern part of the district, where the rocks are effectively concealed over many square miles. There is also heavy drift north of Dolgeville.

Till. The till varies much in character, the variation being mostly in the rock ingredients, which are mainly of quite local origin, as is usual. In and near the pre-Cambrian area it is rather light colored and excessively sandy, and this is its character throughout the Adirondack region. Elsewhere it is nearly black and much less stony, which is due to its large content of soft, black Utica shale. It seems to acquire large depth only where filling preglacial valleys. The black till is magnificently exposed in the banks of West Canada creek and many of its tributary creeks from the east, often forming perpendicular cliffs up to 100 feet and more in height. There are also high till banks in Spruce creek north of Dolgeville, and in the creek tributary to East Canada at Ingham Mills. In these the till is overlain by heavy sand deposits, at the base of which large springs issue.

Moraines. The heaviest development of morainic accumulation within the map limits is along a line running southeast from the northwest corner to Barto hill and thence eastward through Salisbury Centre to the easterly limits. The moraine is broad on the east and west but narrows in the center. On the east it is associated with a considerable development of kame hills and great overwash sand and gravel terraces. On the west these features are lacking. There is a line of kames to the north of Salisbury Centre, culminating in the "Pinnacle", and to the south of this line a great development of low sand hills and terraces. On the west the kames and sands are lacking, the moraine is associated with heavy till, and, though broad, has no great depth over the till. This moraine would seem the eastward prolongation of the one mentioned by Brigham as blocking the valley at Holland Patent, and the topographic maps seem to indicate that much of its course between is marked by heavy kame sands, as is the case here.¹ West of West Canada creek a heavy moraine appears which would seem to serve as a possible connection between the one above described, and the one described by Chamberlin as coming up to Ilion from the southwest.

Sands and laminated clays. Northward and northwestward from Dolgeville is an area of deep sands. Much of it is built into kame hills in association with the moraine. Much however forms flat topped benches with steep sloping fronts. Boulders occur here and there on the surface, though always sparsely. Some gravel is often associated. They lie at all sorts of levels from 800 up to 1500 feet. Their form is often that of delta deposits, but, if such, they represent merely very local and rather rapidly shifting water levels. If the moraine was formed by the shrinking Mohawk glacial lobe, persisting after all ice had disappeared from the foothills to the north, there would be opportunity for the formation of small local lakes along the ice edge, while retreating back from this position, in which the discharging waters of both East Canada and Spruce creeks would build successive

¹*Op. cit.* p.191.

deltas as the water level fell. It will be an interesting matter to determine if any correlation be possible between these levels and corresponding ones formed by West Canada creek.

South of Dolgeville, and east of the creek, is a sand terrace with summit level of 800 feet, and a line of morainic hills to the east which culminates in the knob just opposite Dolgeville. The sand overlies till, has a depth of from 20 to 40 feet, and seems to be a delta deposit, of East Canada creek in all probability.

The sand and gravel shoulder about Herkimer, with summit at about 600 feet, has been correlated by Brigham with similar deposits farther up the Mohawk valley at the same approximate level, all of which he regards as having been formed in a small lake with water at the 600 foot level, held up partly by ice at Little Falls and partly by the rock barrier there, since trenched by the river.

Below Little Falls is a prominent sand and gravel terrace, with much coarse gravel on the north side of the river, whose summit is between 460 and 480 feet. It is found on both sides of the river, though most extensively and least interrupted on the north. Though slightly higher, these levels are quite concordant with those of the similar deposits described by Brigham as extending from East Creek (just beyond the map limits on the east) down to Amsterdam, at about the 440 foot level, and regarded by him as indicating static water at that level, held up by some as yet unknown barrier at or below Amsterdam.

At several localities finely laminated, plainly water-laid clays, nearly or quite destitute of pebbles, were noted. They seem of necessity to mark static water conditions, yet are at such varying altitudes, and run up to such high levels, that they can be attributed only to a series of wholly independent and very local water bodies.

Just west of Dolgeville is a flat topped, steep fronted sand and gravel terrace with a summit elevation of 840 feet. One and one half miles north of Dolgeville, on the divide between Spruce and Cold creeks, are finely laminated clays at 900 feet. The lamination is so fine and even that the material was mistaken for

weathered Utica shale before it was closely examined. To the north, and overlying this, is a sloping sand terrace at from 1000 to 1040 feet, followed to the north by the heavy sand hills of the kame moraine. The whole combination seems to indicate a local obstruction of the drainage coming down from the north by the ice lobe, as it was retreating south from the position of the moraine, forming a small lake in which the clay was laid down, on top of which the streams thrust out a delta. Further retreat permitted the formation of the lower delta near Dolgeville.

Still farther north, the "Pinnacle" kame sands are seen to lie on a similar laminated clay, which there is at 1200 feet. In the single exposure seen the dip is at first nearly flat and then rapidly changes to one of 45° to n. 50° w., suggesting a possible disturbance by the ice, in which case the clay would antedate the last ice advance.

In the tributary to Crum creek at Manheim Center, at an elevation of 520 feet, is a laminated, fine clay with occasional minute pebbles. It lies too high for association with the 440 foot water level, and seemingly too far east to have any relationship with the 600 foot level west of Little Falls. It shows no associated sands, and appears to be overlain by morainic accumulations, in which case it also must have been laid down prior to the last advance of the ice.

But whether these different clays are older or younger than the time of last ice advance, their great variation in altitude affords a difficult matter for explanation, and seems to the writer to indicate small water bodies produced by extremely local conditions.

Drainage. Brigham has sketched an outline of the drainage development of the district in preglacial times, with which the writer is in full accord and to which he can add nothing. To this, those interested are referred.¹

Just before the onset of the ice, the drainage of the district consisted of the main, east-west trunk valley, worn out along the belt of weak rocks under the Medina, into which came tributary streams from the north and south, the whole constituting a well developed drainage network which had carved prominent valleys.

¹*Op. cit.* p.184-92.

The main valley was only partially filled by glacial deposits, and was reoccupied as the main drainage channel on the retreat of the ice. The main change effected was the shifting of the position of the divide between the easterly flowing stream in one, and the westerly moving drainage in the other end of the valley. The present divide is at Rome, is of the most trivial description and is composed of glacial deposits which manifestly could not have formed a preglacial divide. The preglacial col was in all probability at Little Falls, as urged by both Chamberlin and Brigham. Here the valley is narrowest, here is the most resistant rock mass anywhere in the valley, brought up on the west side of the fault, and here the drainage adjustment of the long, preceding time of wear would inevitably locate the divide.

After the ice had disappeared from the Mohawk valley but was still blocking that of the St Lawrence, the waters of the Great lakes went to the sea by the Mohawk valley route, and this great rush of water must have been very efficient in cutting away the rock obstruction at Little Falls. On the other hand, it is obvious that at this time the divide could by no means have had the height of the present valley walls, nor even that of the pre-Cambrian surface at the fault line (600 feet), the latter being more than 100 feet above the present divide at Rome. Chamberlin has suggested that the outer and wider gorge at Little Falls was cut during interglacial times, and this is very probable; at all events, it is certain that the inner gorge represents the total amount of cutting since the ice retreat. This interglacial erosion of the col, together with the heavy drift deposition about Rome, shifted the divide to that point, so that between the two points there is now easterly, where formerly was westerly, flowing drainage.

Brigham has argued that the preglacial course of West Canada creek was by way of Holland Patent, where now is a broad, open valley occupied by a small stream. Certain it is that from Prospect to its mouth the stream is not in its old channel, and that from Prospect to below Trenton Falls it is not in an old channel of any sort.

From Middleville to Herkimer the course of a small preglacial stream is apparently followed, whose source was at Middleville,



D. McBride, photo.

View on East Canada creek $\frac{1}{2}$ mile above Dolgeville, where its course is through a drift-filled valley. Compare with plates 6-9.

where there was in all likelihood a minor divide, located by the more resistant rocks domed up there. This col must also have been cut down in glacial times and quite probably by glacial erosion at a time when the full current of ice swept over the Adirondacks. Though constricted, the valley is not a gorge at Middleville, is U-shaped, there is neither fall nor rapid in the stream, and the knobs of pre-Cambrian rock near the creek level show unmistakable evidence of glacial wear. Just above Middleville, too, the valley is heavily clogged with drift to below the creek level, and even immediately below the town, where the valley is narrowest, till descends in places to the stream level.

East Canada creek also, so far as it lies within the map limits, is not in its old valley, though where that was can only be conjectured. From Dolgeville to the fault line it is in a wholly post-glacial valley, with rapids, and a high fall with a gorge below. Below the fault the stream enters the east side of a preglacial valley, which lies to the west of its present course, and out of which it turns into the modern gorge above Ingham Mills. For a mile below Ingham it apparently crosses another preglacial valley, nothing but drift showing in the banks and bed, and begins to disclose rock again in the bed just before leaving the sheet, beyond which it has cut another rock gorge.

North of Dolgeville the stream is in a preglacial valley, out of which it turns at the big bend to the east [see pl. 15, and compare with pl. 6, 7, 8, 9]. To the northward along this line there is heavy drift, with no rock showing, for some miles; and on the prolongation of the same line to the south no rock exposures occur over a belt at least a mile in width, all the way to the Mohawk. The course of a preglacial valley, rather closely following the Little Falls fault line and lying between that and the present valley of East Canada creek, is thus rendered probable, and such a valley would also seem likely on structural grounds, adjusted to the belt of weak Utica shales between the Little Falls and Dolgeville faults.

The smaller tributary creeks all show the same general features; here they develop rapids, falls and gorges; above and below they show nothing but heavy drift in banks and bed. Their present

courses were determined by the contours of the deposits left by the retreating ice sheet, and do not correspond with the old valleys in position but cross them at varying angles. The present rock-bound portions of their courses are due to the uncovering of hill-tops and divide summits of the preglacial topography, which lay buried beneath their modern courses when they first assumed them. When they occupy, or cross, old valleys, they have not yet been able to cut down to their rock bottoms and have only partially removed the drift filling. The modern valleys are not as large, as deep, nor as mature, and the surface relief is not as great as before the appearance of the ice.

Spruce creek presents some interesting features. All the upper part of its course closely follows the pre-Cambrian edge. This contact forms a natural drainage line because of the southwesterly slope of the resistant pre-Cambrian surface uncovered by the retreat of the Beekmantown inface, and there must certainly have been a preglacial stream here. Brigham has noted the corresponding position of Black river, which follows this contact for miles.¹ The present divide between Spruce creek and Black creek (an affluent of West Canada creek which flows to the northwest along the contact line) is a moraine ridge near the north limit of the sheet. Both these streams are in their old valleys, though where the preglacial divide was is uncertain, the writer however suspecting that it was at or near Diamond hill, and that the present upper part of Spruce creek is in the old Black creek valley, the drainage now being reversed. However that may be, the gorge at Diamond hill is modern, either because of the cutting down of a col, or because the stream is there turned aside out of its old valley. Just below, the valley is blocked by a moraine, and to the eastward of the gorge no rock shows at the surface for a mile, so that we are not limited to the supposition of a col at this point to explain the present course of the stream. From Diamond hill to the fault line the stream is occasionally out of the old valley, specially at Salisbury Center, thence its course to its mouth is

¹*Op. cit.* p.186.

through the drift of the old, deeply filled valley east of the fault line. There is no wide outlet valley into this through which the preglacial Spruce creek could have come, and there must have been once a col at the fault line, but this would have been cut back, and the narrowness of the old valley would seem due simply to the great hardness of the pre-Cambrian rocks in which it was cut.

The heavy drift filling for several miles east of the fault line, as contrasted with the abundant rock outcrops on the west side, shows that in preglacial times the fault was a more conspicuous topographic feature than is the case now, and this by an amount measured by the unknown thickness of the drift over the rock on the east side.

These old, buried valleys introduce an element of uncertainty into the areal mapping of the rocks. For the most part they must be ignored, since their location is unknown; and, where they have been located, the depth of drift is unknown, so that the precise rock horizon beneath can not be told. Whenever they exist, the areal map is likely to be somewhat in error in regard to the surface rock.

ECONOMIC GEOLOGY

Building stone. The Lowville limestone has been the main quarry rock of the district, and has had a considerable local use. It is in general quite massive, not excessively jointed, of pleasing color and quite durable. It has been more largely quarried at Ingham Mills than at any other locality, though several other quarries have been opened, the location of the principal ones being shown on the areal map. The big Dolge mills at Dolgeville are constructed of it, the locks of the Erie canal also and many other smaller structures. It makes a most excellent building stone, admirably fitted to supply all local necessities of the sort. It has also been somewhat burned for lime and would seem the most suitable of the local rocks for the purpose.

The Beekmantown rocks have been somewhat quarried at Little Falls, the lower layers being used, and slight openings have been made elsewhere. While not as good as stone as the Lowville, this

rock has had considerable use at Little Falls for purposes for which stone of inferior quality answers equally well, since it costs less than the other at Little Falls, because of its nearness.

The syenite has also been quarried for building stone near Little Falls. It supplies only a local use and mainly for rough work. The excessive jointing is a defect, in that very large blocks can not be procured, but, on the other hand, it vastly diminishes the expense of quarrying. The stone is for many purposes an excellent one, much of it is of good quality, the supply is ample for all local use, and, since it is the only locality in the valley where a crystalline rock suitable for building purposes occurs, a future demand for it will inevitably arise.

Road metal. There is an inexhaustible amount of good road material to be obtained within the area covered by the map, and, as road improvement is likely to be a matter of the near future, this is a fact of considerable importance. The pre-Cambrian rocks furnish the best material, but the Lowville and Trenton limestones also afford excellent stone for the purpose.

The big diabase dike which cuts the syenite just east of Little Falls on the north side of the river, is the best source of road metal in the district from the standpoint of quality, and, since the dike is over 100 feet wide, the amount available is not small. Since also the adjacent syenite is nearly as well adapted to the purpose as the diabase, there need be no careful separation of the two in working out the material at the edge of the dike.

Next to the diabase the syenite is the best road metal rock in the district. Near the depot at Little Falls the syenite is all cut up by a fine grained, red rock of granitic make-up (an aplite), which is so rich in quartz as to be a rather poor road rock. But the cliffs to the eastward show but little of this rock, so that there is a large quantity of excellent and easily accessible material.

The rock at Middleville would be equally good for the purpose, but the quantity in sight above the level of the creek is very small.

Much of the pre-Cambrian rock to the north would also serve the purpose well. The syenite gneiss is best, while the red granite gneiss and the light colored, Grenville quartz gneisses are not well adapted and should not be used.

Next to the pre-Cambrian rocks the black, slaty limestones of the passage beds afford the best road material, and have already been somewhat used for the purpose in the district. The main objection to their use is expense in quarrying, since the shale partings must be rejected, and these constitute half the bulk of the rock.

Both the Lowville and Trenton limestones will furnish an acceptable road metal, the former better than the latter. The Beekmantown rocks are in general too sandy, and much inferior to any of the foregoing.

The advantage of the pre-Cambrian rocks over the limestones is in their superior durability, along with sufficiently good binding power. But the work must be done with much more care in order to produce satisfactory results, and where this can not be done, the limestone is the preferable material.

Clays. Use has been made of the clays in but one locality, A. C. Kayser manufacturing brick from a clay bed just out of Dolgeville to the west.¹ There would seem no good reason why an excellent quality of common brick, and tile also, should not be manufactured from the laminated clays in several localities, provided exploitation shows the clay present in sufficient quantity, as is in all likelihood the case.

Sand and gravel. There is a great abundance of both these materials for all possible uses, both in the Mohawk valley and also along the line of the great moraine which follows rather closely the pre-Cambrian boundary.

Salisbury iron mine. The only locality within the sheet limits at which iron ore has been found in anything like workable quantity, is at the above mine, 2 miles north of Salisbury Center. Considerable ore has been obtained at this location, some quite

¹Ries, H. N. Y. State Mus. Bul. 35, p.713.

recently. But at the time of the writer's visit work was not in progress and no very satisfactory observations could be made.¹ The working is in the nature of a pit with a maximum depth of some 80 feet, the sides are perpendicular, there was some 20 feet of water at the bottom, and adjacent surface exposures are of the most meager description, so that information must be sought from either the inaccessible sides of the pit, or else from the dumps.

The main pit is from 25 to 30 yards long, from 3 to 4 yards wide, and bears nearly east and west. The dip is to the south and very steep, some 75° to 80° . The pay streak was evidently lens-shaped, pinching out at the two ends of the pit, and nothing could be learned regarding its exact size, or the purity of the ore. To the west no rock shows in outcrop, but to the east, after a 10 yard gap with no exposures but in which the ore had evidently pinched out, is another opening showing a much narrower ore body, beginning with a width of 6 inches and widening to 3 feet. Apparently mining here was never profitable, as the opening is very shallow. At the extreme east end the ore again pinches out and beyond occurs only in small, interrupted masses.

Practically the only rock outcrops are those of the vertical walls of the pit. Little pure ore was found on the dumps, but much lean ore was there, consisting largely of what must have been the immediate wall rock, a very basic hornblende gneiss. This is found to pass into a gneissoid syenite, all intermediate gradations being found. The syenite shows a local phase characterized by abundant mica (biotite) which is unlike any other rock of the district. The ordinary syenite passes into a very quartzose syenite, which is full of quartz and pegmatite veins.

A short distance north of the main pit is a low rock knoll, exposing a well banded, rusty gneiss, full of quartz veins, from which no fresh material could be obtained, and whose precise nature is uncertain, though it much resembles the acid phase of the syenite mentioned above. Near the narrow opening a basic,

¹Since then, some farther exploitation has been done but no opportunity to revisit has occurred

garnetiferous gneiss outcrops, whose relationships are also uncertain.

One quarter mile to the eastward, along the strike, are outcrops of apparent syenite gneiss, but just north, massive ridges of Grenville gneisses cut it out, and just south are granites and dubious gneisses which are certainly not referable to the syenite, so that we are dealing here with an exceedingly small syenite intrusion, if it really be that rock.

The ore itself is of the platy sort, rather than of the granular crystalline character of much of the magnetite of the eastern Adirondacks. In this respect it is like much of the Franklin county ore. Now, while the writer has had no opportunity carefully to investigate these ores, the small study that he has been able to give them leads to the belief that many of them are of igneous origin, being basic segregations from the syenite magna, just as the titaniferous magnetites are segregations from the anorthosite. But, whereas ores of the sort are quite customarily developed in gabbro intrusions, they have been seldom noted in syenites, so that the matter requires thorough investigation, and the statement of origin is only tentatively advanced. The Salisbury ore also seems to fall into the same class, but, because of the poor exposures and the very small size of the mass of apparent syenite, the writer rather hesitates to advance the idea, though himself rather confident of its verity. If the mass be a result of differentiation in an intrusive, it is remarkable, not only because of the kind of rock involved, but also because of the great amount of differentiation in a very small eruptive mass. The thin sections seem to bear out the idea of the igneous nature of the whole, as will be shown later.

PETROGRAPHY OF THE PRE-CAMBRIAN ROCKS

Grenville rocks. These are old aqueous rocks which have been so excessively metamorphosed as to have become entirely recrystallized, with loss of all original structures, so that the main argument for their origin is that based on composition. As occurring in the district, they consisted mainly of shales and

shaly sandstones, limestone being absent. These are now gneisses of various colors, from white to black, nearly always containing pink garnets, and with the darker varieties often holding graphite as well.

What are supposed to have been shaly sandstones are now white to gray, or greenish gray, gneisses, which are rather well banded, thus hinting at a sedimentary structure due to variation in composition of different layers. If this banding does represent original bedding, then the present foliation conforms in direction with it.

To the eye these light colored gneisses appear very quartzose, but the microscope dispels the impression. No case has been observed in which the quartz constitutes so much as 50% of the rock. It commonly runs from 30% to 40%, seeming always somewhat subordinate to the feldspar in amount, the ratio between the two varying from 3: 5 to 4: 5. Most of the feldspar appears to be anorthoclase, as indicated by its faintly moiré appearance, but often a very considerable percentage of an acid plagioclase (apparently between albite and oligoclase) is present in addition. Other minerals than quartz and feldspar seldom constitute as much as 10% of the rock and often fall below 5%. Minute zircons usually occur in considerable number, so much so as to form a prominent feature of these Grenville rocks. Small garnets are frequent. A little biotite, a little magnetite and an occasional titanite are the other customary minerals. The silica percentage must lie above 75% in all cases, and it is believed that chemical analyses would point strongly toward a sedimentary origin for the rock, as suggested by its mineralogy and appearance.

These quartzose gneisses contain bands of somewhat more basic character, which differ from them mainly in the larger content of garnet and biotite, and in usually holding graphite in addition, mostly in minute scales and in no great quantity. One large garnet was noted full of inclusions of a green spinel, probably pleonaste. The minerals other than quartz and feldspar make from 15% to 20% of the rock. The quartz percentage is nearly or

quite as high as in the more acid gneisses, the basic minerals increasing at the expense of the feldspar.

There is also much of a more basic, heavily garnetiferous rock interbanded with the lighter colored one. Its mineralogy is much the same as that of the white gneisses in respect to the minerals present, but there is a great change in quantity. There are the same abundant small zircons, quite a little graphite, pyrite and apatite are present, a little magnetite, quite a lot of biotite and abundant garnet. All together these make from 30% to 50% of the rock, garnet alone constituting from 20 to 30%. The remainder of the rock is made up of feldspar, nearly all of which is microperthite, only a little acid plagioclase being present. The rock is practically free from quartz, all there is being found as inclusions in the large garnets. It would seem to have the composition of a calcareous shale, yet is not at all the sort of rock customarily produced from such shales by metamorphism, as amphibole of some sort usually develops in quantity. In fact, the rock may not have been calcareous, since, if present, the lime is now in the garnet, and it has not been analyzed. If it be a lime garnet the deep seated conditions prevailing during metamorphism may account for the character of the rock.

There is another variety of the above rocks which is characterized by abundant pyrite, roughly some 5%. It also has a considerable quartz content, some 25%, and more than half of the feldspar is plagioclase, an acid oligoclase with maximum extinctions of 10° . There is also considerable of a thoroughly rotted bisilicate. Biotite is present in large quantity and garnets are sparing or absent. With pyrite decay the rock weathers rusty. All sorts of gradations between all these types occur, but taken as a whole they characterize the sedimentary Grenville of the district.

Along with the foregoing are occasional bands of a rusty weathering gneiss which, when fresh, is seen to be thoroughly gneissoid, foliae of glassy quartz grains alternating with black leaves of more basic mineral fragments, the whole making a rather dark colored rock. Yet it shows a higher quartz content than any other, that mineral making fully two thirds of the rock. It is of

coarse grain but not of the leaf type, and holds a multitude of inclusions of the other minerals, along with a little apatite and many zircons. Except for these inclusions the quartz foliae are entirely of that mineral.

Between is a mosaic of garnet, augite, bronzite and feldspar, with many minute graphite scales. Oligoclase is the prevailing feldspar, though with anorthoclase also. Notwithstanding the high quartz content, the rock holds more lime and magnesia than any of those already mentioned and would seem to have been a calcareous sandstone. It grades into less quartzose varieties.

Associated igneous gneisses. Mingled with the Grenville sediments, often intricately, are other gneisses, some of doubtful, and some of pretty distinctly igneous character. These rocks are always thoroughly gneissoid, retaining no more trace of their original texture than is the case with the old sediments, so that again the argument for their origin is mainly based on their composition. The dubious rocks are of so many sorts and shades that it is difficult to treat of them except in a mass of details which would be out of place here. Some of them may likely be foliated contact rocks, and others may be due to a development of mixed rocks along the contacts of the aqueous and igneous rocks by an interchange of materials during metamorphism, though it is not at all certain that such transference ever takes place to any important extent, even during very deep seated metamorphism.

The probable igneous rocks show a range from the most acid granites through syenitic rocks to heavy, black rocks of gabbroic composition.

The granitic gneisses are usually of red color and mainly composed of quartz and feldspar, the gneissoid character being dependent on the development of quartz of the leaf type in thin foliae, separated by fine quartz feldspar mosaic. The quartz makes from one quarter to one half of the rock, the feldspar is mainly anorthoclase or microperthite, though with some oligoclase always, and sometimes a little microcline, and the other constituents are small amounts of zircon, apatite, magnetite and

biotite, with sometimes hornblende also. These taken together often constitute no more than 5% of the rock, and seldom exceed 10%. There are occasional coarser feldspar fragments present which may represent crystal remnants of the original rock that have escaped the prevailing recrystallization.

The syenites are gray to greenish gray rocks, commonly rather quartzose, which approach granites on the one hand and gabbros on the other. Except for their close association with the Grenville sediments, they are not to be distinguished from the thoroughly gneissoid phases of the later syenite, whose description will serve equally for them.

The original gabbros are now converted into hornblende or pyroxene gneisses. On the one hand, are hornblende, biotite, plagioclase gneisses; on the other, augite and bronzite (or hypersthene) appear instead of hornblende. In the pyroxene gneisses garnet often occurs, magnetite always and pyrite sometimes. The feldspar ranges from andesin to labradorite; but not infrequently a large part of it is not plagioclase at all but of intergrowths, either of micropertthitic or of micrographic habit, and such portion may make more than 50% of the whole, giving the rock more of a monzonitic than of a gabbroic make-up.

Syenite gneiss. The area given the syenite coloration in the northeast portion of the geologic map is constituted of quite homogeneous rocks, of thoroughly gneissoid character, gray to greenish gray color, rapidly weathering brown, and of syenitic make-up. They vary somewhat in coarseness of grain and considerably in their quartz percentage, some of them being very acid. There are occasionally to be seen slightly larger feldspar fragments which seem to be of the nature of augen, and around which traces of cataclastic structure appear. But these are small fragments at best, the structure traces are obscure, and the evidence of igneous origin from this standpoint very slender. If, however, the writer be correct in referring the augen character of the syenite at Little Falls to an original porphyritic structure in the rock, then the absence of that character here may have no

further significance than to denote the original lack of that structure.

The rock is composed of quartz and feldspar with varying amounts of biotite, augite, bronzite and hornblende, and with magnetite, apatite, zircon, and a little occasional titanite as accessories.

The quartz content ranges from 5% to 25%. It is evidently all recrystallized and commonly of coarser grain than the other minerals, though never prominently of the leaf type. Its increase in amount is accompanied by diminution of the dark silicate content, specially of the augite and bronzite.

Feldspar makes from 65% to 85% of the rock. It is mostly of faintly moiré appearance, seldom well marked microperthite, and is presumably anorthoclase. But some oligoclase is always present as well, usually in small amount, but rising to as high as 25% of all feldspar present. The mineral is usually in equidimensional grains, constituting a fine mosaic, and, except for an occasional larger individual with traces of cataclastic structure, seems to have been wholly recrystallized. The larger fragments are usually of well marked microperthite.

Biotite is the most constant of the dark silicates, occurring in nearly all varieties of the rock, and being practically the only one to persist in the more acid varieties. Bronzite is perhaps next in abundance. Sometimes all four (bronzite, augite, hornblende and biotite) are present, and then biotite plays a subordinate role. Including magnetite these minerals never make more than 15% of the rock, and in the quartzose members may fall below 5%.

Rocks at the Salisbury iron mine. *Ore.* The thin section of the purest ore which the writer could find on the dumps shows the presence of many inclusions of other minerals, though indicating that these are not present to the amount of more than 15% to 20%, and hence that the ore is rich, though there is nothing to show how large a proportion has this character. Professor E. W. Morley was so good as to make a test of the ore for titanium, his

result proving that the ore is not titaniferous to any appreciable extent, the figures being certainly under .5%.

The inclusions are of apatite, augite and quartz. The two former are numerous, though rather small, have good idiomorphic boundaries against the magnetite, specially in the case of the apatite, which clearly formed before the magnetite, as did apparently some of the smaller augites also. The augite is of pale green color, without pleochroism, exactly like that of the wall rock.

The quartz inclusions are of much interest. They are of the elongated leaf or spindle shape, like the quartz of the inclosing gneisses, and some of them are of large size. Polarized light shows that they are composed of a much greater number of separate mineral fragments than usual, and all show strong undulatory extinction. Around many of them is a zone, or rim, of finely crystalline augite. These rims are also duplicated in some of the inclosing gneisses and seem clearly due to reaction between the magnetite and quartz. In the gneisses they only form between magnetite and quartz. They are exceedingly like the augite rims which form about quartz inclosures in basic igneous rocks. Why they do not occur about all the quartzes is a puzzle. The writer is disposed to regard the presence of the quartz in the ore as due to metamorphism and attendant recrystallization, whence it would follow that the rims formed as a result of the same process.

Walls. Inclosing the ore, and grading into it, is a very basic gneiss composed of hornblende, magnetite, augite, feldspar and quartz, the black minerals constituting 75% of the rock. Hornblende is much the most abundant of these. About equal amounts of quartz and feldspar are present, the feldspar being part oligoclase and part anorthoclase.

So far as can be judged from specimens obtained from the dumps, this gneiss grades rapidly into a more feldspathic hornblende gneiss, and the latter into a syenite gneiss, at first basic but rapidly becoming more acid.

The more basic rock shows abundance of fairly coarse hypersthene, which is platy, lies in the foliation planes, gives the rock a

green and black mottled aspect, and seems certainly secondary and formed during metamorphism. There is considerable magnetite in the rock, which shows augite rims wherever it is in contact with quartz and also around the small quartz inclusions. A little biotite and green hornblende are present, and considerable apatite, the latter often of large size and full of black, dustlike inclusions. The feldspar is mostly anorthoclase, though quite a bit of oligoclase is present. There are some larger feldspars which seem to have escaped recrystallization, and these are micropertthite. Quartz is but sparingly present, mostly in coarse leaves, though also as inclusions in the coarse hypersthene and magnetites. It is present to the amount of some 5% only, while feldspar constitutes from 65% to 70%.

The rock seems to be igneous and to be a syenite, though with peculiarities. Except for some possible small amounts of feldspar, magnetite and apatite, it seems to have undergone complete recrystallization. In many respects, notably in the augite rims, it is peculiar and affiliated with the ore.

The last rock of the series strongly resembles the acid variety of the ordinary syenite gneiss of the region. It is mainly a feldspar quartz rock. In addition are numerous small zircons and a little apatite, biotite, magnetite and hornblende, all together not constituting over 5% of rock. The feldspar is mostly anorthoclase, though with a little oligoclase in addition. The quartz forms some 20% of the rock and is mainly in rather coarse leaves. The rock is wholly recrystallized, but has syenite composition.

We seem here to be clearly dealing with a basic segregation in a rather acid rock of probable igneous origin. But the exposures are so poor, and the whole series so metamorphosed that no decisive evidence is forthcoming in regard to the origin of the ore. While it seems not unlikely that it may represent an original basic segregation from the cooling intrusive, analogous to the titaniferous ores of the gabbroic intrusives of the region, the evidence is far too meagre to warrant a definite pronouncement in favor of this mode of origin. The ore may equally as well owe its existence to secondary processes.

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See fourth note under Geologist's annual reports.

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Reports 3-19 bound also with museum reports 40-46, 48-57 of which they form a part. Since 1898 these reports have been issued as bulletins. Reports 3-4 are out of print, other reports with prices are:

<i>Report</i>	<i>Price</i>	<i>Report</i>	<i>Price</i>	<i>Report</i>	<i>Price</i>
1	\$.50	9	\$.25	15 (En. 9)	\$.15
2	.30	10	.35	16 (" 10)	.25
5	.25	11	.25	17 (" 14)	.30
6	.15	12	.25	18 (" 17)	.20
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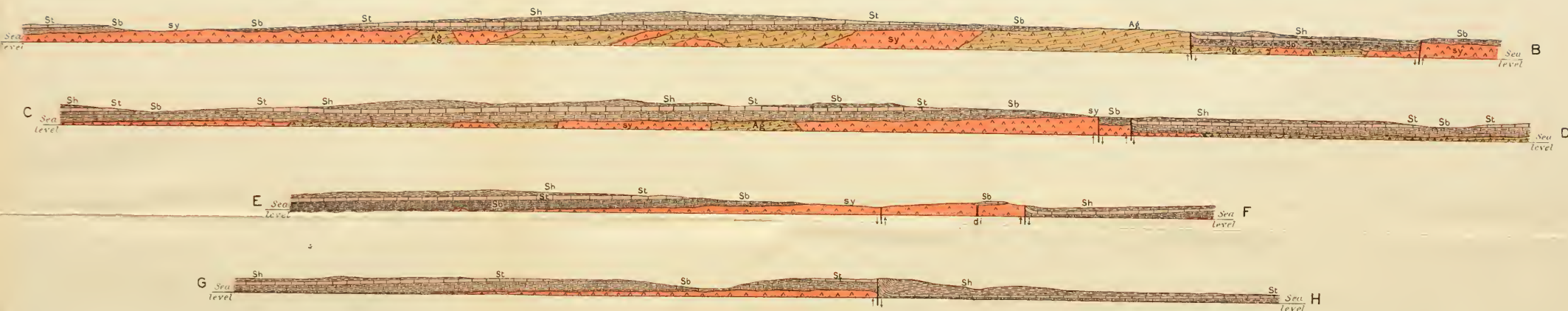
Descriptions and illustrations of edible, poisonous and unwholesome fungi of New York have been published in volumes 1 and 3 of the 48th museum report and in volume 1 of the 49th, 51st, 52d, 54th and 55th reports. The descriptions and illustrations of edible and unwholesome species contained in the 49th, 51st and 52d reports have been revised and rearranged, and, combined with others more recently prepared, constitute Museum memoir 4.

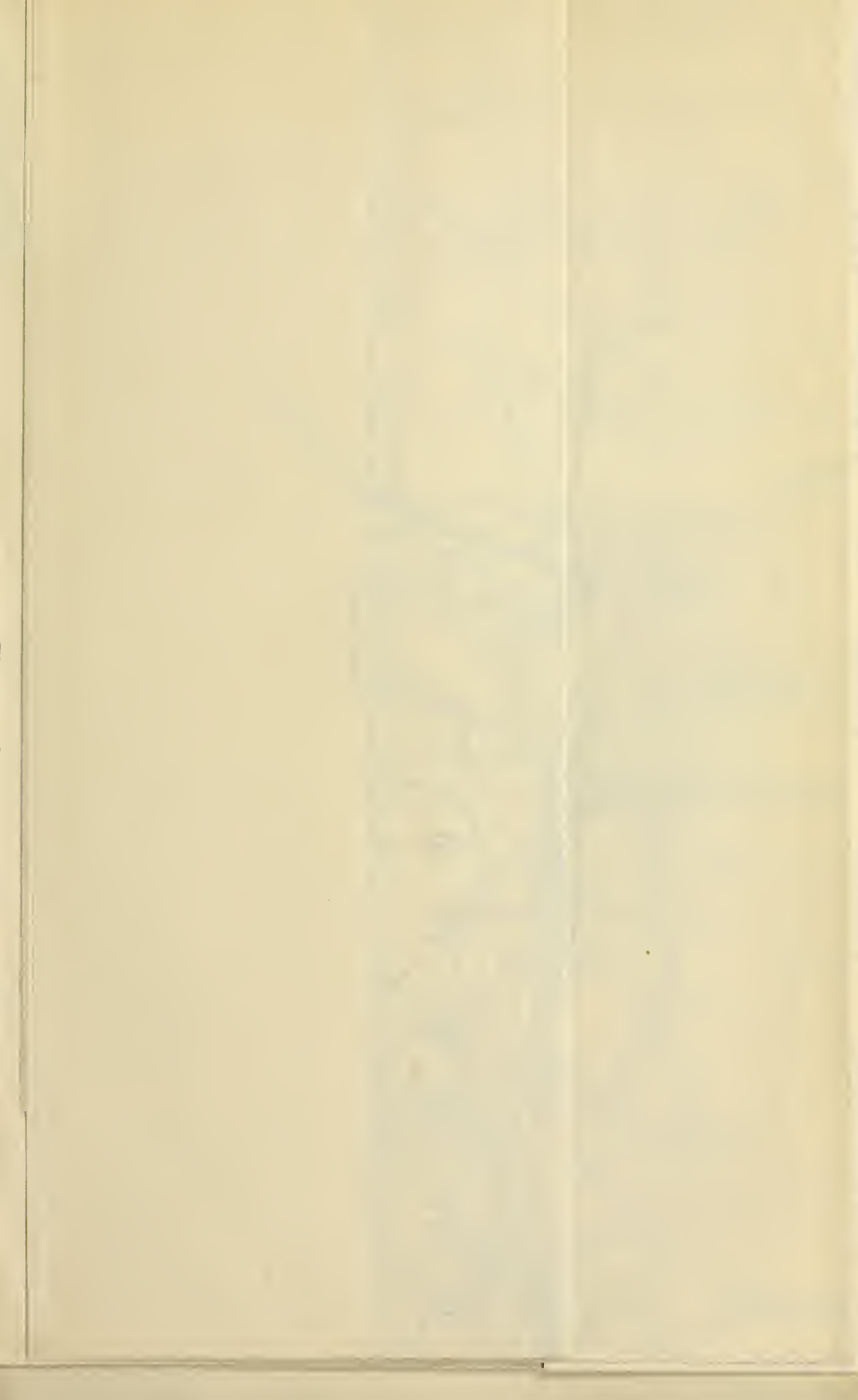
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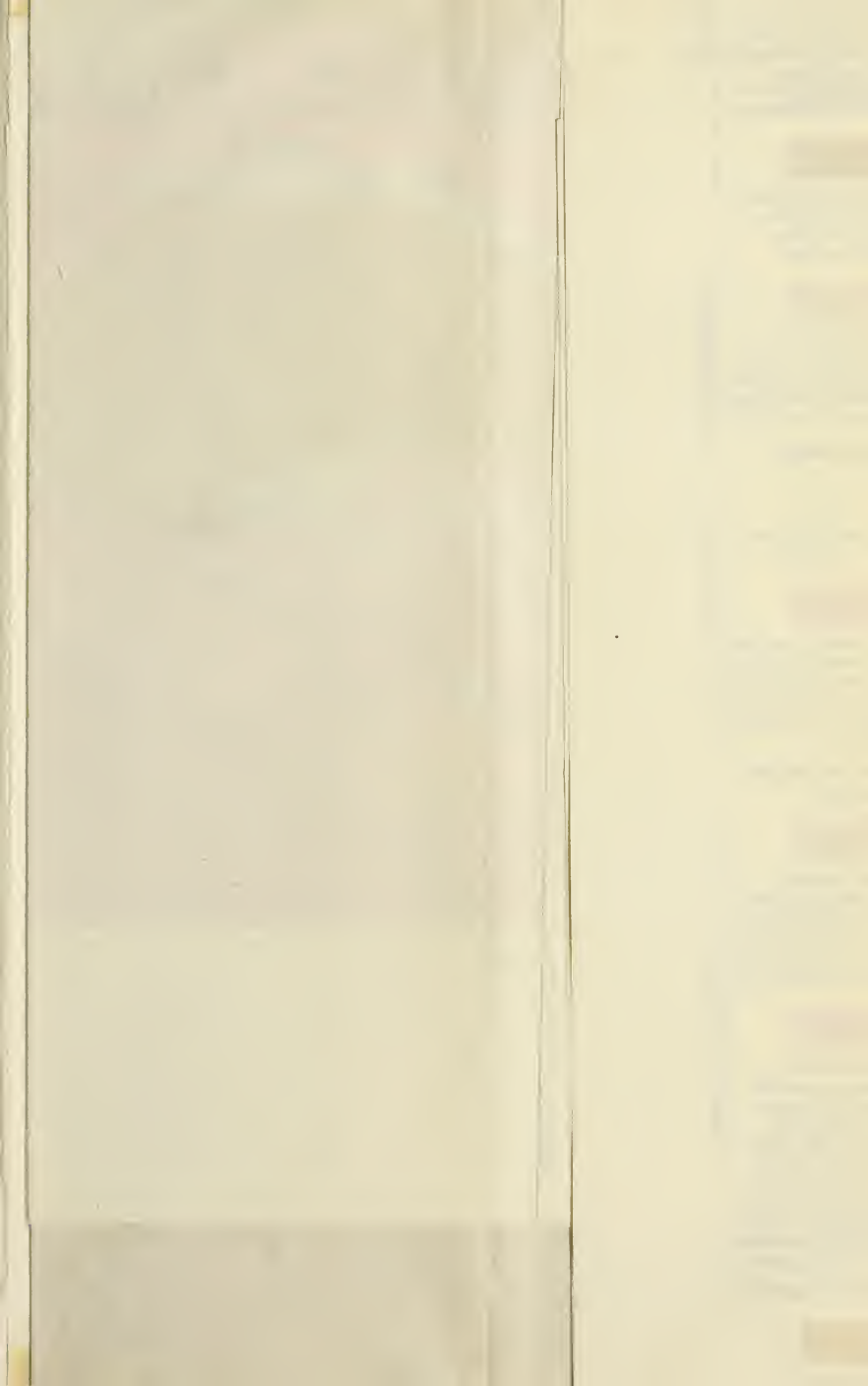






Widmer, J.







LEGEND

SEDIMENTARY ROCKS

Modern valley alluvium and mud-drift deposits with some clay and sand and gravel benches and under long till in the Mohawk and West Canada valleys

Post-glacial unconsolidated alluvial deposits

Loam formation, fine black shales with thin layers of silty limestone in lower portion

Trenton 1 is a passage bed, alternating layers of black shale and thin black blocky limestone

Trenton limestone, including the Lewis and Clark River limestone at the base, mostly gray and black thin-bedded limestone

Beekmantown formation, Little Falls dolomite, massive, grey, often sandy dolomite

Greenish formation, various crinoids and schists, mostly quartzite, usually containing garnet and frequently graphite

IGNEOUS ROCKS

Dikes, only dikes, late pre-Cambrian

Syenite, mostly augite syenite, sometimes porphyritic, usually greenish, of post-Cambrian age but much older than the diabase

ROCKS OF UNCERTAIN ORIGIN

Mafic and granitic and black amphibolitic gneisses probably igneous, somewhat involved with Greenish sediments and probably of Greenish age

Very gneissoid syenite gneisses somewhat mingled with granitic gneisses, and with patches of basic granitic gneisses that may be sedimentary in origin. The others appear to be igneous probably a mixed border zone of the syenite

UNKNOWN PRE-CAMBRIAN

Pre-Cambrian but of unknown character, heavy drill

Faults

Iron ore mine

Stone quarries

AB C D E F and GH are lines of Sections

H.M. Wilson, Geographer in charge
Triangulation by N.Y. State Survey and Hersey Munroe
Geography by W.H. Lavelle, C. Bassett and Hersey Munroe
Surveyed in 1936 in cooperation with the State of New York

(Richfield Springs)
Scale 1:62,500
Miles
Kilometers
Contour interval 20 feet
Datum is mean sea level

Geology by H.P. Cushing
1901

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